

"Miller Freeman" Joins BCF Fleet



A \$4-million, 215-foot research vessel that will study the fishery resources of the North Pacific and the Bering Sea and can cruise 13,000 miles at 14-15.5 knots has become the newest member of the BCF fleet. She is the "Miller Freeman," commissioned in Seattle, Wash., on September 9 after an 8,000 mile trip from the yards of the American Ship Building Corporation in Lorain, Ohio.

The vessel is assigned to BCF's Seattle regional office. She will contribute much to the Bureau's studies of such groundfish as halibut, flounders, and cod, the distribution of salmon, and of the sea's mysteries.

The Miller Freeman has aquaria and biologic, electronic, and oceanographic laboratories. She has accommodations for 10 scientists and 26 crew members. She boasts several unusual features: a center-board to reduce the roll at sea; 2 evaporators to distill 3,600 gallons of seawater daily to provide fresh water; a room-sized tank to hold live specimens; and an atomic-energy irradiator to preserve fresh fish.

The vessel is named for Miller Freeman, founder and publisher of the "Pacific Fisherman," who died in 1955. He proposed several of today's international agreements on fishery resources.



1967 U. S. CATCH MAY BE LOWEST IN 25 YEARS

In mid-September, the latest figures on the U. S. catch of fish and shellfish indicated that landings in 1967 would be about 4.1 billion pounds--200 million below 1966 and the lowest in 25 years.

Landings are down appreciably in Alaska and New England. They are up, or at about the 1966 level, in other areas.

Changes in the year-to-year catch of certain species are particularly noteworthy in 1967.

Canned Salmon Pack Lowest This Century

Salmon used for canning in Alaska was down about 170 million pounds from 1966. The canned pack was the lowest in this century.

This year's total Alaska salmon catch probably will not exceed 150 million pounds--183 million less than 1966--and lowest since the 1959 landings of 147 million pounds.

The catch of all salmon species, except kings, was less. Pinks and reds were showing the greatest decline, followed by chums and cohos. The records of the previous ten years indicate that the 1967 catch of pinks was about 45 percent less than 1965; it was slightly less than landings in 1957, 1958, and 1960. The catch of reds was about the same as in 1962 and 1964, but exceeded landings in 1958, 1959, and 1963.

Other Species Decline

So far this year, certain species other than salmon registered declines from 1966:

- Menhaden was down 60 million pounds.

- Haddock, whiting (silver hake), king crabs, and Atlantic flounder landings were less by 20, 17, 16, and 12 million pounds, respectively. Ocean perch, Pacific halibut, sea scallops, and Atlantic cod landings also were down from the 1966 catch.

Shrimp Landings Increase

The decline in the total catch was offset partially by significant increases in landings of shrimp, the country's most valuable species. They rose 46 million pounds.

- The tuna catch was up--yellowfin and skipjack tuna increased 38 and 25 million pounds; bluefin and albacore were down from 1966.

- California anchovies, Pacific hake, and bonito were up 20, 18, and 5 million pounds, respectively.

No significant trend in the catch of other important species was discernible as the 3rd quarter of 1967 began.

From January through July, total imports of fishery products were 900 million pounds (round weight basis) greater than in the same period of 1966. Fish meal imports were up 1 billion pounds (round weight). Edible fishery products were down 100 million pounds. (BCF Branch of Fishery Statistics.)



UNITED STATES

Hurricane Beulah Battered Shrimp Fleet

In the early morning of September 20, Hurricane Beulah, propelled by winds of up to 160 m.p.h., smashed into the Brownsville, Texas, area. She destroyed many millions in property, made thousands homeless, and paralyzed the area. President Johnson designated it a "disaster area".

Beulah struck the South Texas shrimp fleet at about its peak production period. She knocked out of service about 8 percent of the boats--and sent to the bottom with many of them (in Brownsville and Port Isabel) about 100,000 pounds of shrimp that could not be unloaded in time.

Federal agencies moved quickly to aid the fishermen. The Bureau of Commercial Fisheries announced that the two Interior Department loan programs it administers were available to help replace losses.

The Small Business Administration (SBA) of the Commerce Department announced that its disaster loans, designed to take care of losses not covered by insurance claims, also are available to help restore applicants to pre-hurricane condition.

DAMAGE TO SHRIMP INDUSTRY

Preliminary estimates put the damage to the shrimp industry at \$25-40 million. This

includes 85 to 90 shrimp vessels sunk or beached; 150 more with considerable damage to their hulls; 6 processing plants destroyed, and many others damaged extensively; and shrimp lost on vessels or in cold storage when the electricity was knocked out.

BCF'S LOAN PROGRAMS

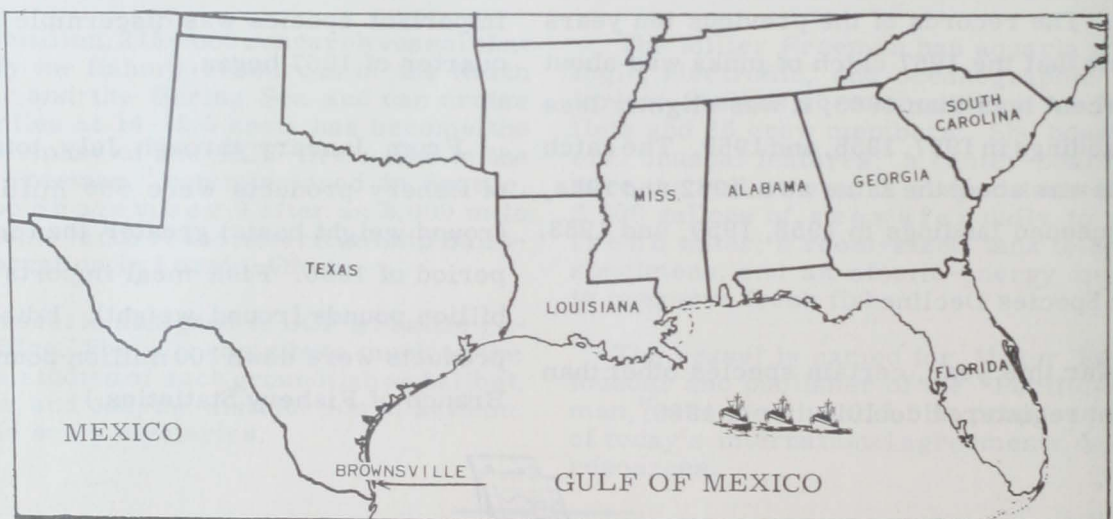
1. New commercial fishing vessels may be financed through BCF's Mortgage Insurance Program. This insures mortgages up to 75 percent of the construction cost. The mortgages have maximum interest rates of 6 percent, 15-year maturities, and one percent insurance premiums.

2. The purchase of used vessels may be financed through the Fisheries Loan Program directly from the Government--instead of from private sources as in the Mortgage Insurance Program.

SBA LOANS

Its disaster loans require only 3 percent interest. Generally, however, SBA will not allow disaster loans for upgrading property. This means that a man who lost a \$10,000 vessel would not receive a loan to buy a more expensive vessel.

SBA has opened an office in Corpus Christi and is opening others in the Brownsville area.



Boston Holds Commercial Fish Exposition

A commercial fish exposition designed to bring together under one roof the major suppliers of fishing and processing equipment--and hundreds of experts from the United States and abroad--is being held in the Suffolk Downs Exposition Hall, Boston, Massachusetts, October 10-14. Its sponsor, "The Boston Globe," sees the exposition as a necessary opportunity for all segments of the fishing industry to discuss domestic and international fishing problems. The exposition is billed as the first international forum for products and ideas held in the Western Hemisphere. Between 5,000 and 10,000 persons from 27 countries are expected to attend.

Over 100,000 square feet of space are devoted to the exposition--more than 150 exhibitors and 200 booths. The exhibits include: vessel design and construction; naval architects and boat builders; propulsion and power; propellers and transmissions; gears and hydraulic haulers; detection equipment and techniques; nets and ropes; twines and cables; buoys and lobster pots; electronics, radar and sonar; pumps, winches and gear; fish handling equipment; processing and packaging machinery; preserving and refrigeration; bread-making machinery, ice making machinery; chlorinators; packaging and containerization; modern transportation methods; seafood processing and packaging.

Speakers and Seminars

Under Secretary of the Interior David S. Black is the featured speaker at the opening dinner on October 10. Senator Edward M. Kennedy of Massachusetts is the featured speaker at the Fish and Seafood Dinner on October 13. Gordon O'Brien, manager of the Canadian Fisheries Council, speaks on problems facing world's fishing industry, particularly of Canada and U. S., on Canada Day, October 13.

Senator Warren G. Magnuson of Washington, chairman of Senate Commerce Committee, conducts seminar, October 11, on government subsidies to fishing fleet, and answers questions of a panel of shipbuilder, ship owner, and naval architect.

On October 12, there are two 1-hour seminars: "Propulsion"--the efficient use of diesels; "Modern Fishing Techniques"--

"How Scottish Seining can increase catch up to 8 times over current methods." On October 13, "Electronics"--latest techniques and equipment for detection and communication; and "The Captains Speak Out"--successful captains discuss industry problems from the fisherman's point of view.



Conflict Over the Atlantic Estuaries

The oceans of the world are not full of fish. As a matter of fact, says David Bulloch, acting president of the American Littoral Society, "the deep ocean is a desert. Only scattered oases of fish life occur where currents converge or an undersea mountain rises near the surface. The real abundance of sea fish is close into land, along open coasts and in the deep bays, and tidal waters of estuaries. Here they are vulnerable to all man's activities. Because we are not practicing conservation of estuaries, we will be faced with threats of serious depletion of fish resources if something isn't done soon."

Bulloch had in mind the quickening pollution of the coastal waters and the physical damage to the estuaries, shallow tidal lands, rivers, lagoons, bays, and sounds along the U. S. coasts--findings of an 84-page, illustrated booklet, "Fish & Man," written by John Clark, and published recently by the American Littoral Society.

Several of the Society's conclusions are:

- "Fish resources are the economic mainstay of hundreds of coastal communities. Salt water fishing is a three billion dollar business in the United States. Commercial fishing is the key to prosperity for many seaside towns while sportfishing supports the economy of many resort areas. Apart from any economic gain, fishing provides a necessary recreational outlet for many of our people. Fish resources of the seashores and bays of the Atlantic coast are in danger of depletion from poorly planned community and industrial development."

- "It is the sad truth that our Atlantic estuaries are not being maintained in good condition - instead they are being systematically demolished, altered or poisoned in almost every town and country along the sea coast. Big and small projects are gradually eating

away this precious environment and wreaking havoc with fish and shellfish resources harvested there. For example, Lake Worth, a Florida salt lagoon and historically a great salt water fish producer in the Palm Beach area, is now almost devoid of useful fish life."

- "Of the tidal wetlands along our North Atlantic coast, from Maine to Delaware, 45,000 acres of marshland were destroyed in the ten year period 1955-64. An accurate inventory kept for the last five of those years showed that 34 percent to fill for housing developments; 15 percent to recreational developments (park beaches, marinas); 10 percent to bridges, roads, parking lots, and airports; 7 percent to industrial sites; 6 percent to garbage and trash dumps; and 1 percent to other causes."

- "Other activities that may alter estuaries to the detriment of Atlantic coastal fish are digging of boat channels, mosquito work, gravel and sand mining, highways with oceans, marshes and dams and other water control structures."

The booklet explains that the waters of the ocean nearest land produce most of the fish because the shallow, brackish waters of the estuaries receive the fertilizing minerals washed into them from the land. Sunlight reaches to the bottom of bays and tidal rivers and stimulates lush plant growth. Estuaries are among the world's most fertile areas. Bait fish, worms, shrimp, plankton, and shrimp thrive--and they provide estuarine fish the nourishment they need for growth and health. Many coastal fish depend on the estuaries for sanctuaries or nursery areas.

The report does not brush aside the legitimate need by communities for some estuarine land. "Critical decisions must be made whenever progress conflicts with conservation of natural resources." But it urges that these decisions be made with care--after the facts have been gathered by experts and all parties have had their say.

The booklet contains summaries of the situation existing in the 14 states along the Atlantic Coast. Each state conservation agency reviewed its State's section.

MAINE

The estuarine habitats of the lengthy coast line have suffered only minor physical dam-

age. But it is necessary to plan orderly land use now to prevent the losses suffered by Connecticut, New York, and Florida. Maine's estuarine losses so far have resulted from dredging in shallow waters and piling the dredge spoil on good wetlands. There is little shore development now because more than 98½ percent of the coast is privately owned.

Maine and the U. S. are jointly acting to preserve some high-value marshes, particularly those between Kittery and Portland, by buying them for natural areas. "But local appreciation of the value of estuarine area appears to be lacking."

The estuarine areas, especially the tide flats, produce many clams. Estuarine conservation attention is now on shellfish. The estimated annual take from the flats range from \$2,000 to \$46,000 per acre. The flats also produce millions of dollars of sandworms and bloodworms each year. Mostly, they are shipped to states along the whole Atlantic coast as bait for sportfishermen.

NEW HAMPSHIRE

"The estuarine zone of the New Hampshire coast is just now coming under serious attack." The better upland areas along the coast are being used up rapidly by developers, who also are encroaching on the marshes. The first marsh losses were caused by dredging and depositing of spoil on wetlands to make boat channels, marinas, housing lots, bridges, roads, and parking lots.

Seeing the menacing wave, several state agencies joined to preserve the marshes and mudflats through educational activities to acquire wetland property for conservation. They concentrated first on the "irreplaceable" Hampton marshes. "A small amount of acreage has been acquired but real danger still exists."

"A real roadblock to effective planning of New Hampshire estuarine land use is confusion over jurisdiction and ownership."

To preserve estuarine areas, they must be acquired for public management, or laws must be enacted to govern private land use--as is done in Massachusetts.

MASSACHUSETTS

"With long coastline and miles of estuary Massachusetts has taken a lead among states

in protecting its tidelands. . . has made outstanding progress in the past five years with a successfully combined scientific and legislative drive to protect its tideland habitats."

The Department of Natural Resources fashioned a crash program because of its deep concern for the future of salt water fish and shellfish resources, the plight of waterfowl and shore birds, the need to control erosion, and to protect "scenic, historic, and tourist values."

The Department conducted a research program that substantiated the importance of estuarine areas to fish. "The conclusion from all these studies is obvious--fishing in coastal waters around the Commonwealth would be nearly ended if all the estuaries were destroyed. And yet many forces are at work to adjust that."

To date, Massachusetts "has lost about 20 percent of valuable tide-marsh and estuarine habitat, but still retains about 45,000 acres to sustain the fisheries." The Department says "dredging and filling projects present the most overt threat to our coastal wetlands."

"Less than 10 percent of Massachusetts wetlands acreage has been protected by local action such as zoning. . . ."

Protective Legislation

Following the scientific studies, Massachusetts enacted legislation in 1963 giving legal control over coastal wetlands projects to the Department of Natural Resources. A supplementary act passed in 1965 gave the Department more authority to protect wetlands. "It provided for state acquisition by eminent domain; and for compensation to the owner in cases where the action amounted to land-taking." The Department also was given authority to set rules governing wetlands alteration. It is carrying out, in effect, an enforced zoning program by surveying the state's wetlands and assigning values to them.

If all levels of government and conservation groups continue their efforts, the state may succeed in protecting key precious estuarine habitat. "But much more acreage will have to be acquired by the state, the individual towns, and private or citizen conservation groups."

RHODE ISLAND

There is a series of shallow salt ponds all along Rhode Island's southern shore protected on the seaward side by strips of barrier beach. The ponds and adjoining marshes are rich nursery grounds for young salt water fish.

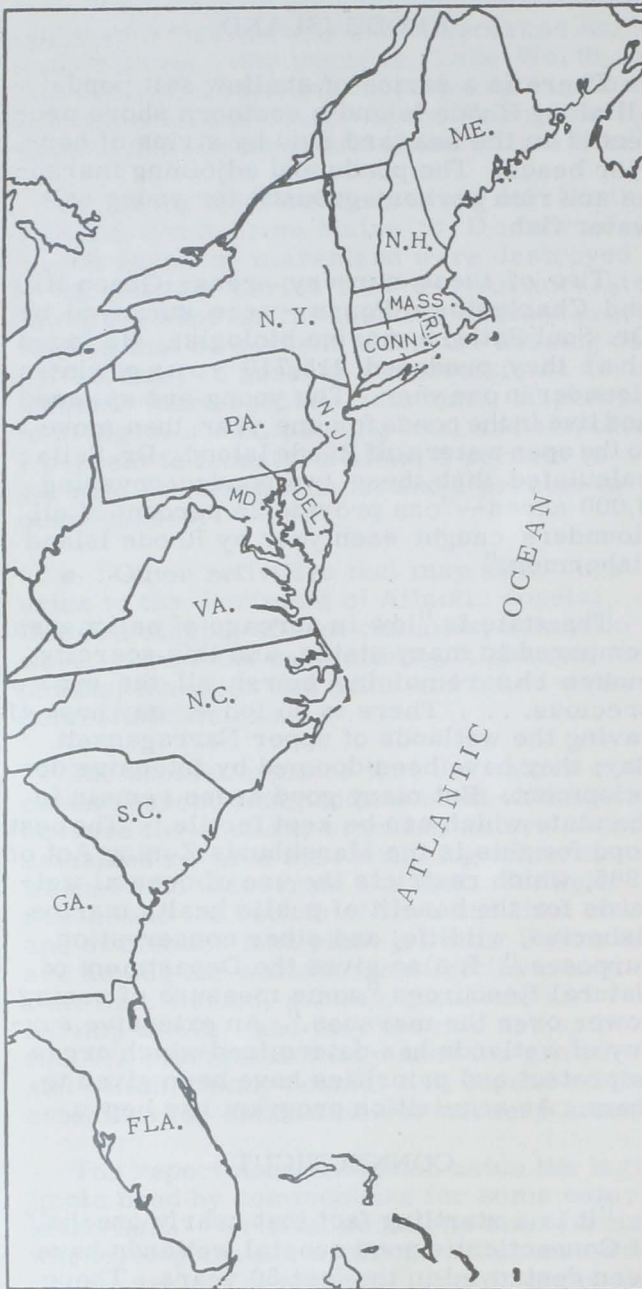
Two of these nursery areas--Green Hill and Charlestown Ponds--were surveyed by Dr. Saul Saila, a marine biologist. He found that they produced 215,710 young winter flounder in one year. The young are spawned and live in the ponds for one year, then move to the open waters off Rhode Island. Dr. Saila calculated that these two ponds--covering 2,000 acres--"can provide 25 percent of all flounders caught each year by Rhode Island fishermen."

The state is "low in acreage of salt marsh compared to many states, and this scarcity makes the remaining marsh all the more precious. . . . There is no longer any hope of saving the wetlands of upper Narragansett Bay; they have been doomed by intensive development. But many good areas remain in the state which can be kept fertile." The best hope for this is the Marshlands Zoning Act of 1965, which restricts the use of coastal wetlands for the benefit of public health, marine fisheries, wildlife, and other conservation purposes." It also gives the Department of Natural Resources "some measure of zoning power over the marshes." An extensive survey of wetlands has determined which areas to protect and priorities have been given to them. An acquisition program has begun.

CONNECTICUT

"It is a startling fact that nearly one-half of Connecticut's good coastal wetlands have been destroyed in the last 50 years. There now remain only about 20 square miles of good wetlands area. . . ." This loss jeopardizes salt water fish resources because, as in other states, most important salt water fish resources depend on wetlands and other parts of the estuary. The fish include striped bass, flounder, bluefish, scup, tautog, shad, and menhaden.

"The greatest threat to the estuaries today comes from dredging activities to make boat channels and marinas." The Board of Fisheries and Game favors public purchase to preserve marshes. "There is no state



control over the tidal marsh areas above mean high water." The Board now owns 3,500 acres of tidal marsh and is seeking funds to buy 7,500 more acres.

NEW YORK

"The alarming conclusion of the most recent survey of Long Island's estuaries is that 29 percent of the marsh and shallow coastal habitat was 'obliterated' in just ten years, from 1954 to 1964." The report

doubted that the remaining 30,600 acres of coastal marshland could be saved.

The state legislature had passed the "Long Island Wetland Bill" in 1959 providing funds up to 50 percent of development and 50 percent of maintenance to town- or county-owned lands dedicated to conservation. But Long Island communities "were slow to take advantage of its provisions."

A bright spot in a gray picture is the achievement over a 6-year period of a group of citizens in the Town of Hempstead. They have "so far saved a major portion of the town's rich and beautiful wetlands from ruin at the hands of developers." The Hempstead marshes support 60 species of fish. In 1966, the group persuaded the town to put aside 10,000 acres for conservation purposes. The action was taken in a joint program with the state under the Wetland Bill. The state will pay for the development and 50 percent of maintenance.

Besides encouraging conservation through the Wetland Bill, the state can do little to save privately owned wetlands. "The state has no control over wetlands in town, county, or private ownership."

Conservationists believe there is some chance of saving much of Long Island's remaining estuarine areas through state purchase. They point to the actions of New Jersey, Connecticut, Rhode Island, and other states.

"Hope is nearly exhausted" for Staten Island and Queens County. Over half their wetlands are gone and "the rest apparently will be gone in a short time." Long Island's north shore is being threatened by recreation development and gravel and sand mining.

NEW JERSEY

"No Atlantic state has better or more varied salt water fishing than New Jersey. Nor does any state derive more economic or social value from its fisheries. . . . Already hard hit by pollution, New Jersey's fisheries are threatened further by physical disruption of valuable shoreline habitat." A report of the U. S. Bureau of Sport Fisheries and Wildlife says that the state's rich estuaries "are of great importance to fish and shellfish as spawning and/or nursery grounds."

Most of the state's valuable and popular fish depend on estuaries of sea coast and of Delaware Bay--striped bass, bluefish, fluke, weakfish, white perch, flounder, menhaden, and others.

In 1954-1964, the state lost 24,600 acres of coastal wetlands--about 9.6 percent of what it had in 1954. Landfill for housing, garbage dumps, industrial sites, and harbor and channel dredging were mainly responsible. Also, the quality of existing areas deteriorated--especially Hackensack Meadows and the shores of Raritan River and Bay--because of siltation, pollution, etc. These losses do not include 10,000 acres of southern New Jersey marshes diked in to produce salt hay. Diking interferes with the access of fishes to the marshes and the flow of nutrients to the sea.

New Jersey legally controls only state-owned wetlands. The state's major program to prevent loss of estuarine area is to buy as much coastal marshlands as possible. In present and planned purchases, the state and the U. S. together will own 150,000 acres of coastal marsh.

DELAWARE

Although Delaware's rich coastal lowlands "have suffered almost every possible kind of disruption over the years... the total loss of estuarine habitat to date through man's maneuvers is not so great as in many other states. But unfortunately, the areas now being threatened are among the most valuable in Delaware for salt water fish."

The most extensive alteration of marshes came through extensive ditching for mosquito control.

Studies by the University of Delaware have shown that the state's estuarine areas are very fertile and able to support substantial marine life. For example, a study of Canary Creek Marsh showed that for each acre of marsh two-thirds of a ton of plant material produced each year is washed out of the marsh to fertilize estuarine area. The plant material becomes fine particles called detritus and feeds many shrimp on the shores of Delaware Bay. The shrimp then feed fluke, weakfish, and others. The detritus also produces Vitamin B₁₂, which is fed upon by oysters, mussels, crabs, and shrimp. Although the marsh has some year-round species, most are tidal migrants.

Beyond the marshes, in intertidal zone of beaches along the bayshore, are more rich areas producing baitfish (anchovy, killifish). The young of valuable species are abundant here too during their first year--young bluefish, striped bass, weakfish, flounder, croaker, menhaden, etc.

The University reports urge preservation of marshlands, particularly those in lower half of the state.

MARYLAND

The booklet bases its Chesapeake Bay section, which describes the Maryland estuarine situation, on the 1961 writings of Dr. Romeo J. Mansueti.

Chesapeake Bay is one of the largest estuarine systems of the Middle Atlantic coast. It is an extremely important spawning, nursery, and feeding area for many game fishes. "In spite of all the changes wrought by man up to now, Chesapeake Bay has been remarkably resilient, and it may still be considered a relatively unspoiled region." Although its overall fertility remains good, "there have been permanent and devastating effects through sedimentation, pollution, wetland reclamation, and dams."

The greatest losses, by far, of wetland areas in Maryland have taken place along the Western Shore, the Bay's northern end, and south along Eastern Shore to Eastern Bay. These areas are being developed rapidly for homes and industry--and wetlands losses totaled nearly 14 percent during the past decade. As population increases, losses mount at a quicker rate. "A long term plan for the preservation of the more valuable wetlands is absolutely essential."

The state's wetlands are largely privately owned. However, there are vast shallower water areas below mean low tide, with a depth of six feet or less, which are state owned. "There appear to be adequate laws to insure that most publicly owned wetlands will not be destroyed indiscriminately." Their future and optimal use should be planned carefully. There are vast areas of privately owned wetlands, over which the state has no control, which are being lost at "an ever increasing rate." Jurisdiction over them rests with local governments--and the state should provide incentives to the former to preserve wetlands.

VIRGINIA

The state has not suffered the serious estuarine damage of many states "but constant vigilance is needed." There are few important salt water fish that are not "critically tied to the estuarine zone for at least part of their lives." Striped bass, white perch, and shad spawn in fresh or nearly fresh water; the young of all 3 live in rivers or brackish upper estuaries. Weakfish, croaker, spot, flounder, bluefish, menhaden, and many lesser species spawn in open salt water--but their young move into shallow areas for feeding and protection during the critical first year.

"Increasing attention must be paid to large-scale engineering projects to protect the valuable estuarine resources of Virginia." The changes in the estuarine area from Back Bay down to Currituck Sound make it difficult to classify the area as fresh or brackish water. Action must be taken if these waters "are to remain as productive fishing area for striped bass, white perch, and for fresh water species such as large-mouth bass and yellow perch; and as nursery area for salt water fish such as menhaden, croaker, and spot."

NORTH CAROLINA

"North Carolina is blessed with an extraordinary abundance of coastal life. Large salt water fisheries, both sport and commercial, and waterfowl resources as well depend on the state's estuarine zone. The shallow sounds, marshes, and tidal rivers behind the outer banks provide a mecca for estuarine life. The outpourings of these shallow areas into the sea provide nourishment for the marine fishes along the outer coast."

The shallow water areas behind the outer banks appear also to be major nursery grounds for many migratory species. Flounder (fluke) populations along the whole coast north to Massachusetts appear to originate in North Carolina estuaries. This may be true too for croakers and weakfish, though they travel shorter distances.

Dangers Threaten

But dangers exist. The recent Intracoastal Waterway dredging operations in Brunswick County caused heavy losses of oysters under cultivation on private and public bottoms. Estuarine mining for phosphate from

the bottoms of the Pamlico River are a threat. The diking off of large marsh areas for mosquito control impoundments "must be very damaging to salt water fish resources." And land developers are threatening the state's large undisturbed natural estuarine areas.

David A. Adams, the state's Fisheries Commissioner, states: "The single most important cause of habitat change and destruction in North Carolina, as well as most other coastal states, is the creating and maintaining of navigational channels and harbors, and the associated reckless and uncontrolled disposal of dredge material." He cites another problem: "Private citizens don't know how much of their alleged holdings of these habitats are valid and neither does the State. Until we have an adequate inventory of this resource, we can't possibly plan for its long-term utilization."

SOUTH CAROLINA

Dr. Robert Lunz, State Director of Commercial Fisheries, referring to work done by Bears Bluff Laboratory, said: "It has been shown that the basic caloric energy released by an acre of marshland is about ten times that of acre of good wheat. This energy from the salt marsh goes into production of sports and commercial marine fish and fisheries. It is now established that 98 percent of South Carolina's fish and fisheries is directly connected, in some manner, to marshlands. The stability of the State's crab crop, shrimp harvest, and oyster production rests squarely on marshlands. Unwise exploitation of marshland must be stopped."

Water control projects are a constant threat to the estuaries.

GEORGIA

"Georgia's extensive salt marshes make her estuarine zone among the most productive littoral areas of the Atlantic Coast. . . . About 45 percent of the plant material formed in the marshes is carried off to fertilize adjacent bays and coastal waters." This material supports marine life--"sea trout, flounder, drum, whiting, croaker, mullet, spot, tarpon, shad, striped bass, sheepshead, cobia, shrimp, crabs, and oysters."

Conservationists believe that long-term planning should be done now. Dr. Eugene P. Odum of the University of Georgia, says:

While we push ahead with research (into estuaries) it is equally urgent that the idea of landscape zoning become generally accepted."

One imminent threat to estuaries is water level control operations in the coastal area. This "endangers salt marshes by cutting them off from the bays with dikes and altering natural water flow patterns." Another threat comes from navigation improvement activities that have "complex ecological ramifications." This is shown by attempts to control the silt buildup in the Savannah waterways by using an "involved hydraulic theory" as an alternative to diverting the fresh water river flow completely away from the harbor. "Loss of fresh water from diversion would alter adversely the whole ecology of the Savannah river estuary, causing pollution problems and detrimental effects on fish and wildlife. . . ."

FLORIDA

"Nowhere in the country is salt water fishing more appreciated or more important economically than in Florida. Yet ignorance of ecological consequences of shore projects, short-sighted public works, and uncontrolled fast-buck schemes have probably had a more ruinous effect on coastal resources in Florida than in any other state. No Atlantic state faces more serious problems in littoral conservation. . . ."

Losses due to shorefront development appear to have significantly affected coastal living resources." But in 1964, the state strengthened its controls over bulkhead lines, submerged land sales, and dredge permits. In 1965, Florida created the first in a series of large marine preserves.

Dredge-and-fill projects have caused much damage to coastal resources. A notorious example is Lake Worth, long a productive brackish water lagoon. Fish catches have declined drastically. This is blamed on physical changes in environment from dredging and from muck materials from the Everglades brought down by the Palm Beach Canal. Canal building produces ecological disruption and is another growing threat to salt water and inland fishing.

Still A Chance

Figures for 1961 showed that Florida's coastline of over 8,000 miles had been developed 20 percent. "Changing economics

will require that much of this be re-developed." And this will provide another chance to regulate coastal development soundly.

One of the most promising precedents in conservation is the setting up, in 1966, of a 10,000-acre marine preserve in the Estero Bay, which includes the northwest fork of Loxahatchee River (between Ft. Myers Beach and the Lee Country mainland). At least 6 other outstanding marine areas are being considered for inclusion in a system of marine preserves under the management of the Florida Outdoor Recreational Development Council.



1967 Shrimp Catch Expected to Set Record

The U. S. shrimp catch in 1967 probably will exceed the previous record of 160 million pounds (heads-off weight) taken in 1954, according to BCF. As a result, shrimp prices are much lower than a year ago. U. S. fishermen capture most of their shrimp along the Gulf Coast from Florida to Texas.

The U. S. is the world's leading shrimp consumer--accounting for about one-third of the world catch.



Sea Scallop Supplies Drop, Prices Rise

Supplies of sea scallops this year are nearly 40 percent less than a year ago. Their abundance apparently has declined to levels before the large catches of the late 1950s and 1960s.

The decline has had a self-regulating effect on the New England scallop fleet. Thirty scallop boats now operate out of New Bedford. There were 34 at the start of 1967 and 38 at this same time last year. In the early 1960s, the New Bedford fleet had 70 scallop vessels. Substantially higher exvessel prices this year have compensated for the lower catches. Fishermen are now receiving about 50 percent more than a year ago. Consumption has dropped a third from last year because of higher

prices due to lower catches and a marked decline in supplies. Retail prices for frozen sea scallops in mid-August were at an all-time high. There seems little likelihood of price weakness for the fall and winter. Institutional users may find current shrimp prices more favorable than those of scallops--and substitute more shrimp.



Puerto Rican Fisheries Development Aided by U. S. Funds

Scientists of the University of Miami Institute of Marine Sciences are helping the Commonwealth of Puerto Rico develop its commercial fisheries. Dr. C. P. Idyll, Chairman of the Institute's Division of Fishery Sciences, is directing an analysis of current commercial fishery operations in the Commonwealth to establish guidelines for the industry's development.

Puerto Rico became eligible for matching funds from the U. S. under the Commercial Fisheries Research and Development Act. The Act was designed to help the individual states enlarge and maintain fishing resources capable of yielding maximum production.

The project's principal investigator said: "We want to find out the true value of the current Puerto Rican fishing industry, as well as the seasons and areas in which the fish are caught, and to use these basic facts for planning purposes in order to assign priorities for the future benefit of the Commonwealth's fisheries."

Achievements So Far

To date, the Institute's investigators have helped Puerto Rico buy and equip a 37-foot boat and design another 23-footer for exploratory and demonstration purposes. To support the vessels, they have provided a mobile shore base, which includes an air-conditioned van with self-contained ice-making equipment and insulated ice storage. They have advised in the selection of a site for a fisheries laboratory the Commonwealth proposes to build. They have recommended qualifications and duties of personnel in the development program.

The next step is a statistical study of present fishing practices and yields. A system for collecting these data was developed by interviews with fishermen and buyers. The fishermen catch a wide variety of fish species. These are handled and marketed as classes rather than species, but their principal landings are in snapper and grouper families. There also is substantial production of spiny lobster.

The Institute of Marine Sciences group hopes to help enlarge the fisheries program and have it operate at maximum efficiency--not only for economic benefits but for dietary values. (Institute of Marine Sciences, University of Miami, August 10.)



American Samoa Tuna Price Set

The prolonged price negotiations between Japanese suppliers and U. S. packers in American Samoa for August tuna deliveries finally was settled on September 7. The prices per short ton set by the new, 3-month agreement, are: August--same as July prices (for frozen tuna: albacore \$370, yellowfin \$300, big-eyed \$185 a short ton); September--up \$2.50 a ton for albacore and \$5 a ton for yellowfin; October--same as September prices. ("Suisan Tsushin," Sept. 11.)



Packaged-Type Small Fish-Meal Plants Made by Coast Firm

A line of packaged-type, small, fish-meal plants has been introduced by a Los Angeles, Calif., firm. The firm has been manufacturing fish-meal plants for more than 50 years. The plants are complete, self-contained units. The currently popular Model 22 processes one ton of raw material per hour producing whole fish meal. The units are built for continuous operation. They contain a cooker, drainer, press, solids screen, dryer, meal grinder, sacking unit, and motors, piping wiring, switches and controls. The components are assembled as a complete package on a single-base frame.

The firm's vice president of sales announced that the plants have been developed for canneries, processing plants, and fisheries having limited capacities--either shore or floating installations--for both salt-water and fresh-water operators. He said the plants were "completely self-contained. . . . These compact fish-meal plants incorporate the most modern technology for producing high quality whole fish meal with full recovery of all protein available in the raw material. The process is accomplished without producing any waste water effluent, thus eliminating the question of pollution in inland waters."

Recovers and Uses Stickwater

One of the unit's unique features is the recovery and utilization of stickwater entirely within the dryer of the basic unit. This eliminates the need for a separate stickwater evaporator and greatly simplifies the equipment installation and operation.

The official also said: "One of our customers who is processing lake fish had a costly problem in disposing of wastes from his filleting plant. By installing our fish meal plant, he turned a costly nuisance into a handsome profit. So far, the plants have successfully processed a wide variety of material, including ribbon fish, anchovies, mackerel, and miscellaneous varieties of trash fish caught by shrimpers; as well as wastes from packing operations of tuna, mackerel, crab, shrimp, and even fresh-water carp." (The "Fishermen's News," September.)



In Brief

CANNED KING CRAB STOCKS

On September 1, canners' stocks (sold and unsold) in the U. S. of canned king crab totaled 49,350 cases (basis 48/½'s)--6,988 cases more than on August 1. The September 1 stocks were 75,611 actual cases of fancy pack (71,636 cases were 24/½'s) and 20,452 actual cases of chunk pack (18,696 cases were 24/½'s).

* * *

MENHADEN CATCH

Total catch of menhaden in the U. S. during August was 219.4 million pounds, compared with about 183.3 million pounds during August 1966--an increase of 19.7 percent.

* * *

SHRIMP IMPORTS

U. S. shrimp (fresh, frozen, canned, and dried) imports from all sources in August 1967 were 11 million pounds, compared with 11.3 million pounds for the same month in 1966. Imports during August 1967 of fresh or frozen heads-off shrimp (shells-on) amounted to 6.5 million pounds; peeled and deveined, 3.3 million pounds; frozen breaded (raw or cooked) 1,456 pounds; and other types of shrimp products (some dried and canned) 1.3 million pounds.

Mexico shipped 1.9 million pounds during August 1967 (compared with 2.1 million pounds in August 1966) consisting of 487,820 pounds of fresh or frozen heads-off shrimp (shells-on); peeled and deveined, 1.3 million pounds; and other types of shrimp products, 145,852 pounds.

* * *

BREADED SHRIMP PRODUCTION

During second quarter of 1967, production of breaded shrimp in the U. S. totaled about 18.9 million pounds--a decrease of about 1.2 million pounds, or 6.1 percent, from April-June 1966.

The Inland and Gulf States produced 11.4 million pounds, Atlantic States 5.6 million pounds, and Pacific States 2 million pounds.



OCEANOGRAPHY

Scripps Announces Central North Pacific Study

A pilot program to investigate the vast central North Pacific was announced in September by the University of California, San Diego's Scripps Institution of Oceanography and the Office of Naval Research (ONR). It is designed to obtain knowledge of ocean-atmosphere interaction and to improve long-range oceanographic and meteorological forecasting.

Dr. William A. Nierenberg, director of Scripps Institution, said: "A four-million-square-mile region extending some 1,000 miles south of the Aleutian Islands comprises the area in which we will initiate observations and study of physical changes in the upper ocean layers. If the results of the pilot study warrant, we will plan to carry out a long-range study. Included among the beneficiaries of a long-range study will be Navy vessels and aircraft, U. S. Weather Bureau forecasters, the U. S. Bureau of Commercial Fisheries, commercial fishermen, farmers, ship operators, and UNESCO's World Weather Watch, which is expected to become operational in the early 1970's."

The study's principal investigator is John D. Isaacs, professor of oceanography at Scripps and director of its Marine Life Research Group.

To Install Deep-Moored Stations

To conduct this initial study, Scripps scientists and engineers will install "two clusters of four, deep-moored, unmanned, catamaran-type, floating instrument stations north and northwest of Hawaii." In the center of each cluster will be a 40-foot Monster buoy. The buoy, developed for the Office of Naval Research by the Convair Division of General Dynamics, already has been tested extensively off the Florida coast and Bermuda.

The Scripps-developed instrumented stations, moored in water 12,000 to 18,000 feet deep, will record surface wind speeds and directions and water temperatures at depths to 1,000 or 1,500 feet. A separate station in each cluster will measure ocean currents. The moored stations also will record barometric pressures, solar radiation, and relative humidity.

"The two Convair-developed stations will record water temperature, surface wind, speed, and direction; barometric pressure, precipitation, relative humidity, solar radiation, and wave height." They will telemeter data for immediate use by Government scientists. The Convair-ONR Monster buoy Alpha, anchored off La Jolla, Calif., in early June, was scheduled to undergo long-range telemetry tests.

Cooperating with Scripps and ONR in the study are the Weather Bureau, BCF, the Navy's Fleet Numerical Weather Facility, Monterey, Calif., the U. S. Coast Guard, NASA, and universities.

Knowledge About Surface Waters Sought

Prof. Isaacs said that one of oceanography's critical problems is to determine the nature and causes of the large-scale persistent shifts in temperature of the surface water of oceans. He explained:

"We have long been aware of historical and continuing fluctuations in conditions along most coasts, but it has been only in the last ten years that we have realized that these local changes are only a part of very extensive changes involving entire oceanic regions.

"The immense scale of these changes was revealed by the Bureau of Commercial Fisheries in studies of sea surface temperatures from ship reports.

"The existence of these changes is readily apparent from vessel measurements, but the nature of the processes involved cannot be documented by any feasible ship survey, so we are turning to an array of these successfully tested, deep-moored platforms bearing continuous recording instruments at a number of depths to give us the data we need."



Map Published of Seabed off San Diego, Calif.

A detailed map of the sea bottom off the California coast near San Diego has been published by Coast and Geodetic Survey. The bathymetric map, covering about 5,000 square miles, includes the area extending seaward up

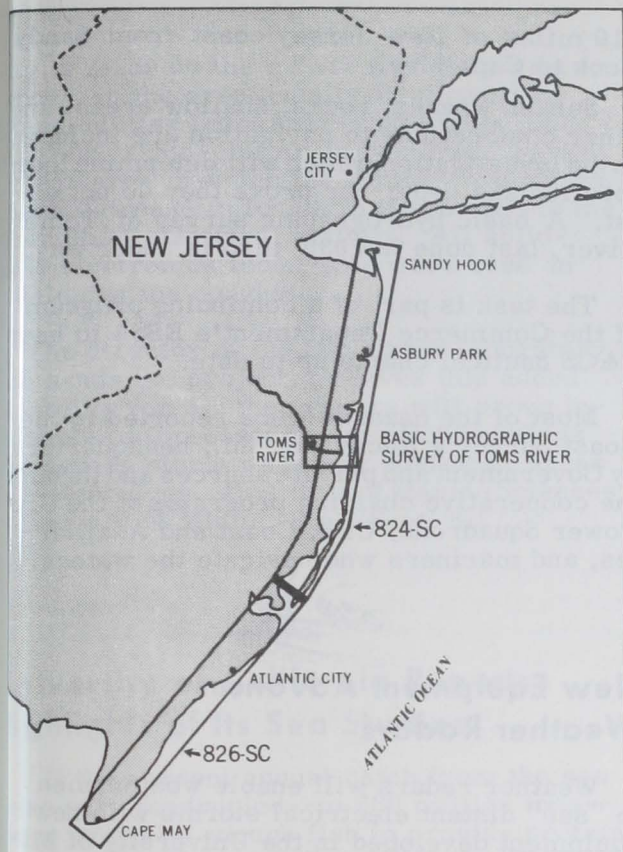


Chart revision survey of 824-SC & 826-SC.

to 50 nautical miles from Huntington Beach, Calif., to Punta Sal Si Puedes, Mexico.

The new map is third in a topographic series of the sea bottom that ultimately will cover the entire west coast. The first covered the area immediately northwest to Santa Barbara; the second extended from Cape San Martin in the north to Point Conception and Santa Rosa Island in the south. Similar maps are being made by the Commerce Department agency of seabeds off the Gulf of Mexico and Atlantic coasts.

Aid Continental Shelf Study

The maps are designed to aid Federal, State, and industrial interests in exploring and developing the potentially vast resources of the Continental Shelf in and under the ocean. Economic development of these resources depends heavily on bottom topographic maps; few exist now.

For the first time, the sea floor off San Diego is detailed by depth contours, from a few feet off the coast, to 6,532 feet at the map's most seaward point.

Prominent underwater feature shown include San Clemente Basin; La Jolla Canyon; Coronada Canyon and Escarpment; San Diego Trough; and Lasuen Knoll. Also included are the Mexican islands of Los Coronados.

Hydrographic surveys dating from 1922 to 1944 were used to produce the new map. It includes an evaluation of hydrographic survey coverage and an index showing survey limits. Undersea features are emphasized in gradient colors.

Designated 1206N-16, the map may be purchased for 50 cents from the Coast and Geodetic Survey (attn C44), Washington Science Center, Rockville, Md, 20852, or from chart distribution centers of the Coast and Geodetic Survey at 121 Customhouse, San Francisco, Calif. 94126, and 602 Federal Office Bldg., 90 Church St., New York, N. Y. 10007.



Seabed of Maine's Gulf Studied

A gravity survey of the Gulf of Maine's seabed was conducted by the Coast and Geodetic Survey's "Discoverer," September 10-25. It included part of Georges Bank. The survey is a key step in determining whether oil deposits exist off the New England coast.

Scientists of the Commerce Department agency were trying to ascertain the field strength of gravity of the seabed off the coasts of Maine, New Hampshire, and Massachusetts in an area extending from Cape Cod to the Bay of Fundy for about 200 miles out to sea.

Dr. Hyman Orlin, a Coast Survey geodesist who headed the project, explained:

"Seismic and magnetic surveys have already been made of the bottom of the Gulf of Maine. When the gravity data is added to these findings, a determination can then be made as to the geological structure of the bottom. This will provide a better idea as to whether oil deposits may exist there."

Survey Part of Large Program

The Gulf of Maine gravity survey was part of an extensive program underway by the Coast and Geodetic Survey to accelerate the economic development of the continental

shelf. This vast submerged area embraces about 800,000 acres off U. S. shores.

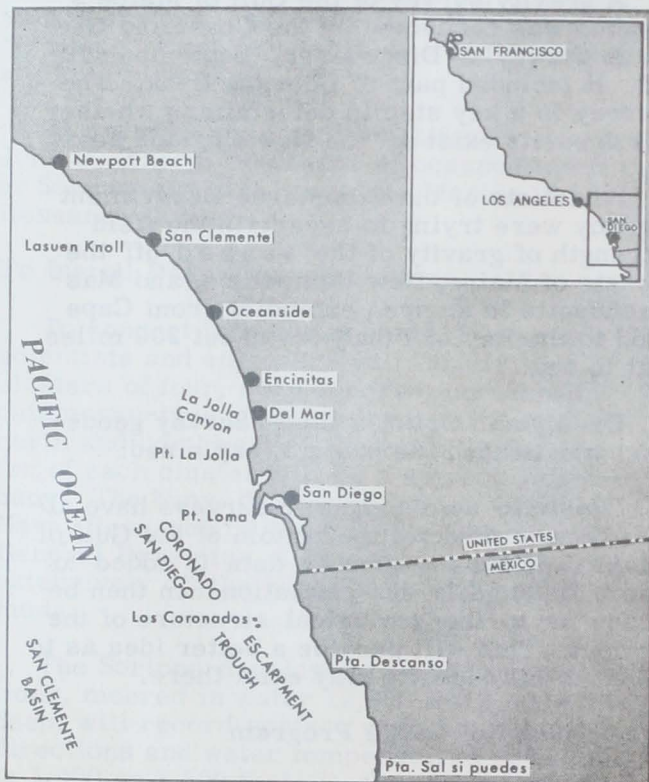
The program produces topographic maps of the seabottom. Bathymetric maps covering the bottom of the Gulf of Maine, the mid-Atlantic Coast, Southern California, and the Aleutian Islands already have been issued.

Dr. Orlin emphasized that the gravity, seismic, and magnetic surveys, supplemented by bathymetric maps, will speed the search for solid minerals, as well as oil, on the continental shelf.



Navigational Hazards Along New Jersey Coast Being Studied

The Coast and Geodetic Survey (CGS) is conducting a 3-month hydrographic investigation of over 100 reported navigational hazards in inlets, bays, and harbors along the



New bathymetric map (1206 N-16) issued by Coast & Geodetic Survey-ESSA covers seabottom off the coast of Southern California and Mexico.

110 miles of New Jersey coast from Sandy Hook to Cape May.

Sunken wrecks, rocks, shallow areas, and other obstructions to navigation are included in the investigation, which will determine their location and depth--or prove they do not exist. A basic hydrographic survey of Toms River, last done in 1935, also is under way.

The task is part of a continuing program of the Commerce Department's ESSA to keep C&GS nautical charts up to date.

Most of the hazards were reported to the Coast Survey's Rockville, Md., headquarters by Government and private sources and through the cooperative charting programs of the U. S. Power Squadrons, U. S. Coast and Auxiliaries, and mariners who navigate the waters.



New Equipment Advances Weather Radars

Weather radars will enable weathermen to "see" distant electrical storms with new equipment developed in the University of Miami Institute of Marine Sciences' (IMS) radar meteorological laboratory. The equipment is known as a Sferics-to-Radar Data Converter. Sferics is the technical term for radio noise produced by electrical discharges in a cloud--whether or not they are great enough to produce visible lightning strokes.

At present, weather radars display areas of rain but observers have no sure means of identifying active thunderstorms. Instead, they rely on their own experience to interpret the display. Although a few sferics sensors are in use, they are not coupled to a weather radar to provide the two items of information on one display.

Rain and Electrical Activity Seen

The new convertor, developed under contract from the Geophysics Branch, Office of Naval Research, adapts signals from a Littoral Systems, Inc., SPARSA sferics sensor in the format of vectors displayed at the same time on the radar screen. Thus, the observer can see which areas of rain are accompanied by electrical activity; from the length of the vector, he can judge its severity. This dis-

ay is made on the center of the radar screen, in the area usually dominated by ground clutter from nearby buildings, terrain, etc. This clutter is removed, leaving a clear area in which the vectors are shown. These increase in length in proportion to the strength of electrical activity. All solid-state electronics techniques were used in developing the convertor.

The director of the IMS radar laboratory, who heads the project, believes this added capability for weather radars will prove invaluable to forecasters, for pilot briefings and severe storm warnings, and other areas of meteorology. (Institute of Marine Sciences, University of Miami, Fla., Sept. 8.)



University of California Reports Highlights of Its Sea Studies

"If the current annual catch from the sea were only quadrupled--to 200 million tons--there would be enough fish to provide protein for the six billion people expected on the earth by the year 2000." The writers of statement--in a special report ("Food From The Sea") to the Board of Regents of the University of California--believe it can be done. They say the oceanographer "knows that the supply of annual protein can be increased ten times with more efficient harvesting of the sea. But he also knows that this increase must await better charting of when and where marine life is, and that to enjoy its potential fully marine hunters must be changed into marine ranchers."

The report discusses the scientific search for food in the sea by the University of California and especially its Scripps Institution of Oceanography. There is urgent need to take more animal protein from the sea's vast storehouse. "Already, 500 million humans suffer from malnutrition for lack of protein, a more frequent cause of death than any disease. And those who suffer from chronic protein starvation are often maimed for life."

What Scripps Is Doing

Several problems under study by Scripps and other University of California campuses are:

The Chain of Life: Dr. J. D. H. Strickland heads the Scripps research group seeking better understanding of the chain of life. Dr. Strickland says the oceanographer "should learn where and when edible sea life may be found in vast areas of the ocean, and how to maintain the supply for an unending harvest." He must learn the pathway of energy in the food chain, how to measure the sea's "standing" stock, and the reproductive rates and growth throughout the system.

The job is very difficult, Strickland says. He notes, however, that scientists are entering an age of automated, sea going analysis. They can record basic facts continuously: temperature, phosphate, oxygen, nitrite, silicate, chlorophyll, and the distribution and size of particles.

Dr. Strickland is searching for artificial ways to recreate the sea's conditions under scientific controls.

Finding the Fish: Until 1950, the adventurous fishermen discovered new fishing grounds. They were followed by the oceanographers.

The University of California's studies of life in the California Current has made the current "one of the best known segments of the sea." Intensive studies were begun following the disappearance of the sardine, once the major catch for California fishermen. The search led to great quantities of Pacific hake and the anchovy, the sardine's competitor.

Conserving the Species: While Scripps scientists seek new areas to fish, they worry about overfishing certain species. Walter R. Schmitt estimates that 90 percent of the world's fishing industry involves a dozen fish: herring, anchovy, menhaden, cod, hake, had-dock, rockfish, mullet, tuna, mackerel, salmon, and flounder.

Scripps studies of the anchovy off Peru disclosed that the fishery had reached its maximum annual rate. The Peruvian government has set conservation regulations based partly on these studies.



Foreign Fishing Off U. S. Coasts in August

IN NORTHWEST ATLANTIC

Soviet: Fog and haze blanketed the Georges Bank area during much of August, restricting aerial observations and limiting somewhat the assessment of Soviet fishing.

The number of vessels decreased sharply from 150 early in August to about 60 by month's end--a normal decrease this time of year. Smaller side trawlers return home after 5 or more months of extensive fishing. Surprisingly, only 10 stern trawlers fished on Georges Bank in recent months.

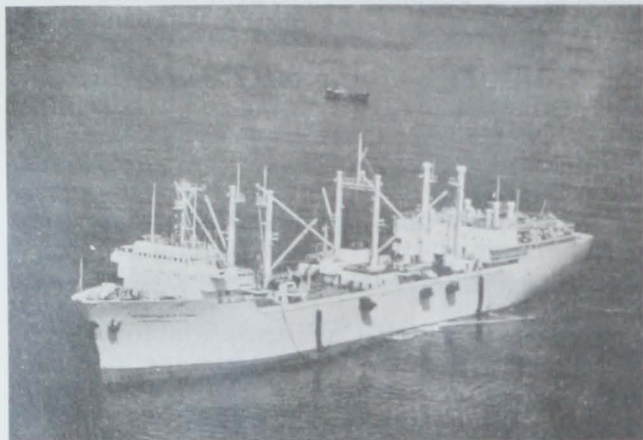


Fig. 1 - Soviet factory base ship, "Leningradskaya Slava," anchored 170 miles east of Nantucket Island, Mass., on June 7, 1967. In the background, a medium side trawler approaches to unload her catch.



Fig. 2 - Large catch of herring on board Soviet medium side trawler fishing Georges Bank area. (Photos: C. L. Philbrook)

Mostly from mid-August on, 74 individual vessels were sighted and identified as 7 factory stern trawlers, 17 medium refrigerated side trawlers (11 SRTR's, 6 SRTM's), 44 medium side trawlers (SRT's) and 3 factory base ships (see photo No. 1), one refrigerated fish transport, one tanker, and one repair tug. In July, an estimated 200 vessels were reported.

Early in August, the fleet worked in two areas: about 125 vessels were along the southeast slopes of Georges Bank and catches were believed to be herring and whiting. In a small area 25-30 miles south of Nantucket Island, about 25 vessels fished mostly whiting and some red hake.

By mid-month, the fleet, already reduced to 60-70 vessels, concentrated in a 25-mile area on southeast part of Georges Bank (Corsair Canyon) fishing at 40 to 60 fathoms. Heavy-to-moderate catches on deck were identified as mainly herring (see photo 2).

By month's end, the same fleet shifted to the inner shoals along Banks' northern edge. Herring in moderate quantity was principal catch.

Other Nations Fish Georges Bank

Late in August, in addition to Soviet vessels on Georges Bank, there were vessels from Poland, West Germany, East Germany, and Romania.

Poland: Two freezer stern trawlers and 8 large side trawlers were observed fishing among the Soviet fleets. Catches appeared to be herring. (About 16 Polish trawlers were reported on Georges Bank in June.)

East German: Five freezer stern trawlers were sighted among the above vessels. At least one fished intermittently on the Banks in recent weeks, apparently searching for fish.

West German: Five stern trawlers arrived late in August to fish for herring--believed the first instance of this many vessels operating at one time. (In the past years, 1 or 2 were reported occasionally but rarely sighted during surveillance flights.)

Romania: One stern trawler, "Galati," was observed on Georges Bank in mid-August but not later in month.

THE GULF OF MEXICO

Cuban: In June and early July, most vessels concentrated off Bahama Islands and north Cuban coast. However, by July's end and during early August, the fleets fanned out throughout the Gulf of Mexico. Their largest concentration, up to 40 vessels, was on Campeche banks off the Yucatan Peninsula; individual units were spread along slope of Continental Shelf (in waters 200-1,000 fathoms deep) of Mexican and U. S. coasts.

In first week of July, the U. S. Coast Guard sighted 6 vessels about 120-150 miles southwest of mouth of Mississippi River between edge of Continental Shelf and 1,000-fathom curve. They were probably long-hauling for tuna and sharks. Another 3 long-haulers were sighted on July 19 in about the same area. This was first time in several years that a sizable number of vessels operated in Northern Gulf of Mexico. One or two years ago, Soviet research vessels were sighted in the same general area.

Most of these vessels remained 50-200 miles from shore (depending on contour of Continental Shelf). On July 30, the "Liseta" and "Aquaji" were sighted off the Louisiana coast, 27° 5' N. and 92° 45' W. No catch information is available. (See "Louisiana," p. 20).

Soviet: Only individual vessels were sighted passing through Florida Straits to or from South American fishing grounds.

OFF CALIFORNIA

Soviet: Throughout August, up to 10 vessels fished off California. On August 4, four large stern factory trawlers were sighted 17 miles northwest of Point Reyes (north of San Francisco). On August 28, one stern trawler and a supply vessel were sighted about 14 miles west of Pigeon Point (south of San Francisco). No catch information is available.

OFF PACIFIC NORTHWEST

Japanese: During August, 3 Japanese stern trawlers operated here, working 50 to 60 miles offshore. Pacific Ocean perch were observed on one vessel.

Soviet: Extensive fog off Washington and Oregon made air and sea surveillance difficult, sometimes impossible. Early in

month, about 70 fishing and support vessels fished off Pacific Northwest, about the same as July. Complete data are unavailable for next two weeks, but at month's end total decreased to about 50. (This compares with 107 in early August 1966 and 82 late that month.)

Notably absent were large stern trawlers; only a few were sighted during last week. Most vessels were medium side trawlers.

Early in month, the Soviet Fleet operated in 5 separate groups off Washington, between Point Grenville and Cape Disappointment; only 2 were sighted off Oregon. During month, however, more vessels drifted south, and 13 were sighted fishing off Oregon by month's end.

Information on Soviet landings is scant. It appears that most catches were Pacific hake, with incidental catch of rockfish species. All available data indicated that total catch of hake this year will not reach 1966's 130,000 metric tons.

The fleet was supported by 5-6 research and exploratory vessels throughout the month.

OFF ALASKA

Japanese: With end of her North Pacific whaling, number of fishing vessels off Alaska decreased from about 200 in early August to about 175 by month's end.

In early August, 8 Japanese trawlers fished for Pacific ocean perch in Gulf of Alaska--4 vessels on Portlock Bank, 3 near Middleton Island, and 1 on Yakutat grounds. By mid-month, number of trawlers increased to 9, as one transferred to Gulf from eastern Bering Sea. Effort shifted during mid-month when Middleton Island area was abandoned. Three vessels continued on Portlock Bank, 2 trawlers resumed operations on Albatross Bank, 1 trawler continued fishing on Yakutat grounds, and 3 trawlers began fishing off southeastern Alaska coast. By end of August, the effort in Gulf perch fishery had increased to 13 vessels--5 trawlers off coast of southeastern Alaska, 1 on Yakutat grounds, 3 on Portlock Bank, 3 on Albatross Bank, and 1 near Chirikof Island. The trawlers fishing in Gulf of Alaska were serviced intermittently by refrigerated transport and cargo ships.

During first-half August, about 9 trawlers, periodically serviced by refrigerated transports, fished for perch along Aleutian Islands Chain: 8 along central Aleutians and 1 south of western Aleutians. About mid-month, a few Aleutian Islands trawlers transferred to

Gulf of Alaska. However, the arrival of new trawlers along Aleutians shortly thereafter increased number to about 10 trawlers. In late August, perch operations like Soviets¹, became more dispersed. One trawler was south of Fox Islands in eastern Aleutians, 4 were south of central Aleutians, and 5 (supported by two reefers) were fishing south of western Aleutians.

In early August, 4 trawlers fished for perch along 100-fathom curve from north of Unimak Pass to northwest of Pribilof Islands in eastern Bering Sea. By late August, 2 of these had transferred to Gulf of Alaska; it is believed the other two continued fishing for perch near Pribilofs.

One small factory trawler remained active on shrimp grounds near the Trinity Islands, off southwest Kodiak Island, throughout month.

Throughout August, 5 fish meal and oil fleets--5 factoryships accompanied by 105 trawlers--continued operations in eastern Bering Sea and northwest of Pribilofs in central Bering Sea. In early August, 2 fleets were on Bristol Bay "flats" east of Pribilofs, 2 fleets were along 100-fathom curve northwest of Pribilofs, and 1 fleet was just north of Fox Islands in eastern Aleutians. About mid-month, one of the fleets from northwest of Pribilofs moved southward along 100-fathom curve to just north of Fox Islands. The disposition of the remaining 4 fleets remained the same as above. By month's end, the area north of Fox Islands had been abandoned. Four fleets were located on Bristol Bay "flats" and 1 just northwest of Pribilofs.

Throughout August, the Japanese tangle-net fishery in eastern Bering Sea--2 factoryships and 10 net-setting trawlers--remained centered on Bristol Bay "flats," about 100 miles north of Unimak Island.

Two trawlers continued experimental pot fishing for crab just north of Unimak Island. Both had been operating since late April and did not end operations in July. Catches consist entirely of tanner crab which are frozen aboard the two trawlers and transported to Japan by refrigerated transport vessels.

Four long-liners fishing for sablefish were reported in Alaskan area during August--2 (1 near Middleton Island in central Gulf and 1 off Fox Islands in eastern Aleutians) were active during first week, then, apparently,

returned home. The remaining 2 vessels were off the 100-fathom curve in western Gulf about mid-month; it is believed they returned to Japan by late August.

A stern trawler was seized on July 16 by the U. S. Coast Guard for fishing within the U. S. 3-mile territorial waters off Aleutian Islands. The vessel was radar-tracked for one hour while fishing near Adak, Alaska. The captain pleaded no contest and was fined \$5,000 by the U. S. District Court in Anchorage. The Coast Guard later escorted the vessel out of U. S. waters.

Soviet: The number of fishing and support vessels decreased from about 50 in early August to about 40 at month's end. This compares with about 40 vessels off Alaska during August 1966.

Pacific ocean perch fishing in Gulf of Alaska remained at low level. Early in month one SRTM (medium freezer trawler) was active off southeastern Alaska, one BMRT (stern factory trawler) fished on the Yakutat grounds, and one BMRT operated along 100-fathom curve in western Gulf. By mid-month there were no vessels in the western Gulf; by end of August, only one BMRT remained in Gulf, fishing Yakutat grounds.

Soviet perch fishing was mostly along Aleutian Islands; about 12 vessels were active throughout the month.

Early in August, 9 BMRT's and 1 SRTM, supported by 1 reefer, were fishing off Seguan and Amukta Islands in central Aleutians, and two BMRT's fished for perch along Near Islands in western Aleutians.

By mid-August, operations had become more scattered along Aleutians. Two BMRT's and 1 SRTM were fishing for perch along Fox Islands in eastern Aleutians, 4 BMRT's supported by a reefer remained in the Seguan-Amukta Islands area, 1 BMRT was north of Andreanof Islands, 2 BMRT's and a reefer were active near the Buldir Island, and 1 BMRT and a SRTM were fishing along Near Islands. No perch catch information is available.

About mid-month, 1 BMRT and 1 SRTM were reported along 100-fathom curve near Pribilof Islands. Those vessels were believed fishing for perch and remained throughout rest of August.

In early August, the deep-water trawl fishery north of Fox Islands was conducted by 10 SRTM's and 1 BMRT catching flatfish and sablefish. By mid-month, there were 5 SRTM's and one BMRT. By month's end, this fishery was ended.

Whaling fleets generally remained well offshore. During early August, one fleet--a factoryship and about 12 whale killer vessels--was just north of Attu Island in western Aleutians. It is believed another fleet was also fishing along Aleutian chain.

About mid-month, one fleet was reported near Pribilofs and one fleet was believed located south of Rat Islands in western Aleutians. Two fleets were believed operating along Aleutians at month's end.

SEIZURE OF SOVIET VESSEL

On August 3, U. S. Coast Guard (USCG) patrol cutter "Avoyel" observed a Soviet medium freezer trawler (probably fishing for ocean perch) hauling gear about 10 miles off Akutan Island in Aleutians (54° 22' N. and 166° 7' W.). The vessel (SRTM-8457 of Far Eastern Fisheries Administration) is the one

seized on March 22 for fishing within the U. S. 12-mile contiguous fishery zone off Alaska (her captain was fined \$10,000). The USCG directed vessel to heave to, but the SRTM headed full speed towards international waters. The vessel was overtaken at about 13.5 miles offshore and boarded for violating 12-mile fishery zone. The USCG 17th District directed Avoyel's captain to seize vessel and tow it to Dutch Harbor on Unimak Island.

The U. S. Government dismissed illegal fishing charges against captain of SRTM-8457 and announced out-of-court settlement of Admiralty suit against vessel's gear.

U. S. Attorney McVeigh and Soviet attorneys agreed to \$20,000 settlement to be paid by the Soviets to avoid Admiralty suit trial.

According to U. S. Coast Guard, Soviet captain was flown out of Anchorage on August 15 aboard Coast Guard plane to Dutch Harbor, where he rejoined his crew and vessel. Immediately thereafter, the vessel was escorted out of U. S. fisheries zone by a Coast Guard cutter.



FISH HEARING LIKENED TO HUMAN SMELL

A fish is in about the same predicament as a man trying to determine the source of an odor as far as telling the location of a sound source is concerned, the Acoustical Society of America meeting in New York was told by Prof. Willem van Bergeijk of the Center for Neural Sciences at Indiana University. Because humans have only one nose, the only way they can detect the direction of a smell is by "sniffing it out," trying here and there until stumbling upon the source. It is believed fish have the same problem locating the direction of a sound since fish have only one middle ear.

Fish can locate a sound source if they are close to it, but they do this through their lateral line (tiny sensory buds spread over the body) which is sensitive not to sound but to the small water currents near the sound source, such as those caused by a wriggling worm. (Reprinted, with permission from "Science News," weekly summary of current science, c 1966 by Science Service, Inc.)

STATES

Alaska

13-MAN TRADE MISSION VISITS JAPAN

A 13-man Alaska trade mission, headed by Governor Walter J. Hickel, visited Japan early in September to talk with industry and business leaders. Gov. Hickel indicated his desire for Japanese participation in the exploration and cooperative development of Alaska's unutilized fishery resources. ("Shin Suisan Shimbun Sokuho," Sept. 8.)

* * *

EDA-FINANCED FREEZING PLANT AND DOCK FOR YAKUTAT

The U. S. Commerce Department's Economic Development Administration has approved a \$831,000 grant and a \$357,000 loan to build a dock and a fish-freezing plant at Yakutat, Alaska. The EDA funds will finance the total project cost of \$1,188,000. The loan will run 25 years at 4 $\frac{1}{4}$ percent interest.

Yakutat is on Monti Bay, an ice-free, deep-water harbor in southeastern Alaska. Fishing is the economy's mainstay. Timber, another resource, is underdeveloped.

The EDA project will include construction of a heavy-duty dock so that steamship service, discontinued because of run-down docking facilities, can be resumed. The project also includes construction of a flash-freeze, cold-storage plant employing 15 workers. The plant also will increase jobs and income for fishermen.

* * *

JAPANESE TO BUY SALMON AND TROUT

Gov. Hickel has announced that the Japanese firm Mitsubishi will station a freezer-ship at Cape Blossom--14 miles south of Kotzebue, just above the Arctic Circle. A U. S. businessman will sell to them 400,000 pounds of chums and 60,000 pounds of trout. The Japanese have agreed also to take all salmon eggs.

The freezer-ship can freeze 7 tons and salt 5 tons of fish a day. Fish will be produced

by about 50 local fishermen. They will get 10 cents a pound for the salmon. (Practically all inhabitants in this general area are Eskimos.) Ashore, about 25 women will be hired to clean and lightly salt the fish. Gov. Hickel said this will utilize the "heretofore undeveloped chum salmon run in the Arctic."

This is the first report of a recent U. S. effort to take Arctic chums commercially. However, the Japanese will have in the area, for the second year, an "exploratory" chum salmon fishing operation. In 1966, a 200-ton vessel "Hoko Suisan", took close to 200,000 pounds of Arctic chums. This year the company will send a 300-ton vessel. At least 10 Japanese fishing companies applied for licenses to fish this year, but the Japanese Government licensed only one. This was due in part to U. S. and Soviet objections to such a fishery.



Louisiana

CUBAN VESSELS FISH OFF LOUISIANA

In August, the U. S. Coast Guard confirmed reports of New Orleans sports fishermen that Cuban vessels were fishing in the Gulf, 40 miles off Louisiana's shoreline. As many as 20 vessels were sighted at one time.

They are conventional steel-hulled vessels 40-100 feet long. They are fishing with thousands of hooks hanging on miles of line strung across tuna and marlin grounds at the edge of the Continental Shelf. The Cuban fishermen string out stout lines of hooks, which often are 5 miles long and have 1,000 or more hooks at a depth of 120 feet.

New Orleans sportsmen complained to the Coast Guard that the Cuban operations are cutting into the supply of marlin and sailfish. The Coast Guard maintains that nothing can be done about it because the fleets are in international waters.



Oregon

RAZOR CLAM YIELD IS BEST IN DECADE

The 1967 razor clam season was the best since 1958 as Oregon beaches yielded more than 1.5 million of them to an estimated 15,000 diggers. The near-record haul came despite an experimental closure of the productive Clatsop beaches from July 15 thru August 31 by the Oregon Fish Commission. The commission sought to curtail the high percentage of small clams wasted during that period.

Ban Is Success

The experimental ban shows signs of being a major success. Preliminary data from the commission's shellfish staff in Astoria indicate a 60 percent reduction from the 1966 wastage of 500,000 small razor clams. Biologists point out, however, that diggers discarded about 200,000 small clams this year--despite the experimental closure and longstanding requirement that the first 24 razor clams dug must be kept regardless of size.

Razor clams may still be dug year-round from beaches south of Tillamook Head. Fair digging can be found on Indian, Arch Cape, and Cove or Falcon Beaches, all in the Cannon Beach area. Clams in these areas were reported quite large.

Commission shellfish biologists anticipate a significant carry-over of large clams on the Clatsop beaches due to the closure. They say the outlook for Oregon razor clam diggers is excellent next year. (Oregon Fish Commission, Aug. 2.)

* * *

EARLY FALL CHINOOK CATCH IS ABOVE AVERAGE

Chinook salmon landings from the Columbia River during the recent early fall commercial fishing season were about 20 percent above the average of the past 7 years. Preliminary figures show that during the 16-day season--from August 6 to August 26--125,600 fall chinook weighing 2,840,000 pounds were taken. Arthur L. Oakley, Columbia River fisheries management project leader for the Oregon Fish Commission, said the figures were based on landings at major canneries and may be revised when all remaining landing reports are in.

The average catch of fall chinook in the August season since 1960 has been 105,000 fish, Oakley said. Based on landings only, it appears the fall chinook run is normal in timing this year and will be near the 263,000 fish predicted by biologists of the Oregon Fish Commission and the Washington Department of Fisheries. (Oregon Fish Commission, Aug. 31.)

* * *

RECORD COHO LANDINGS REPORTED

The best commercial troll landings of coho salmon for a comparable period in the 42 years since complete record keeping began have been reported from Oregon ports thus far this season, according to the Oregon Fish Commission.

In the first 6 weeks of the coho troll season, which opened June 15, commercial fishermen landed 4,098,000 pounds dressed weight. Last year, the landings for the same period totaled 2,647,000 pounds dressed. Since 1948, the average troll landings of coho for the same period have been 1,100,000 pounds.

Robert E. Loeffel, biologist in charge of troll salmon studies for the Fish Commission, said the figures include landings of 390,000 pounds at Ilwaco, Washington, where fishermen who work the waters off Oregon land their catches.

Coho Landings Improve

Coho landings off northern Oregon and southern Washington were relatively light during the first few weeks of the season, but they improved recently, Loeffel said. During the 1966 season, coho fishing generally was better off the southern half of the coast but, during the previous year, it was more productive northward.

The offshore showing of salmon is excellent and substantial numbers of hatchery-marked fish are showing up in the catch. Thus far, Oregon Fish Commission Klaskanine and Alsea hatchery marks have been the most common, although other stations also are represented by fin-clipped fish. In addition to the Fish Commission, the Washington Department of Fisheries and the U. S. Fish and Wildlife Service liberate large numbers of coho each year.

Loeffel said that while the hatcheries undoubtedly are contributing much, the spectacular sport and commercial fishing cannot be attributed solely to hatchery releases. He added that natural spawning still plays an important role in maintaining fish runs. Ocean survival conditions also are extremely important in determining success or failure of salmon production. These conditions, presently not well understood, appear to have been very favorable off the Oregon coast during the past few years. (Oregon Fish Commission, Aug. 8.)



Texas

REPORT ON SHRIMP FISHERY

The Texas shrimp fleet lands about 64,000,000 pounds of shrimp worth over \$25 million each year. About 80 percent of shrimp landed are brown shrimp. Most of the catch is taken within 20 miles of the 375-mile-long Texas coast in 1-5 day trips. When catches off Texas decline, many boats travel to the Bay of Campeche near Mexico's Yucatan Peninsula. Trips there may last 50-60 days. They are usually made in winter, when sudden storms are frequent. For economic reasons, shrimp are loaded on one shrimp or freezer boat and shipped to Texas. This allows the other shrimpers to fish longer and make the trip worthwhile.

Because salt water anglers prefer live shrimp as bait, a multimillion-dollar industry has developed on the Texas coast.

These are some of the facts contained in "The Shrimp Fishery In Texas," by A. W. Moffett, published by the Texas Parks and Wildlife Department.

Industry Developed After World War I

After World War I, commercial shrimping developed from a small, part-time industry to the most valuable sea fishery in the U. S. Texas fishermen played an important part in its development. Modern shrimping is exclusively a bottom-trawl fishery.

With the introduction of trawl, the industry boomed. Fishermen had the tool that needed only a small crew, could catch more shrimp in less time, and could fish efficiently dense shrimp stocks in Gulf of Mexico.

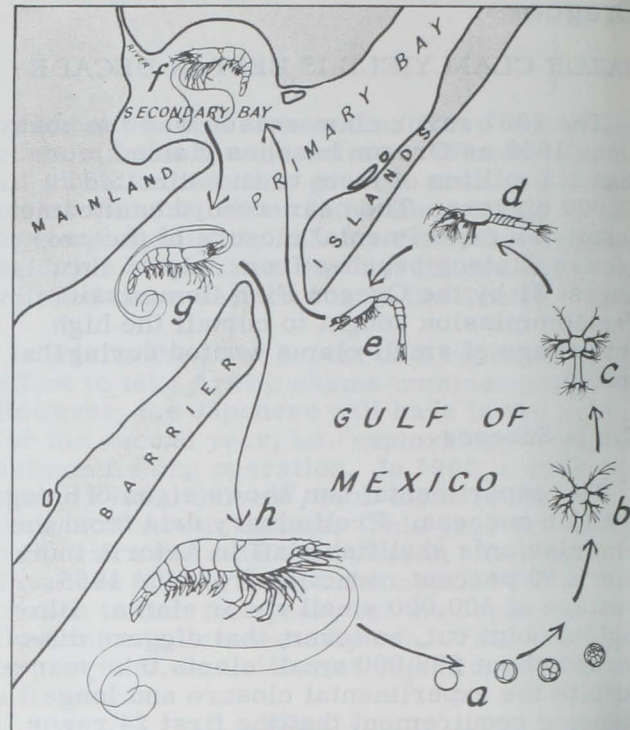


Fig. 1 - Life history of a shrimp. (a) shrimp eggs; (b) nauplius larva; (c) protozoa; (d) mysis; (e) postmysis; (f) juvenile shrimp; (g) adolescent shrimp; (h) mature adult shrimp. (a, b, c, d, and e after Heegaard.)

Before the late 1940s, white shrimp supported industry. After 1947, catches dropped dangerously. Shrimpers were forced into deeper Gulf waters--where they found vast quantities of brown shrimp.

In 1955, shrimpers at Rockport developed a very effective method of trawling--"double rig". A single boat pulled 2 identical trawls simultaneously. The trawls were 40-42 feet wide at mouth. Catches increased 15 to 30 percent. Within 2 years, a large part of Aransas Pass fleet converted to the new system. Its popularity grew and the trend spread to other states. Virtually all offshore shrimp vessels built in recent years were double-rigged; many pull two 75-foot trawls.

Modern shrimp vessels come in all sizes from small "mosquito" boats that shrimp in the bays to 50- to 85-foot super-trawlers that can fish the bays and Gulf waters. Unlike primitive earlier craft, today's large trawlers carry up-to-date navigational aids: radar, fish finders, fathometers, ship-to-ship radios.

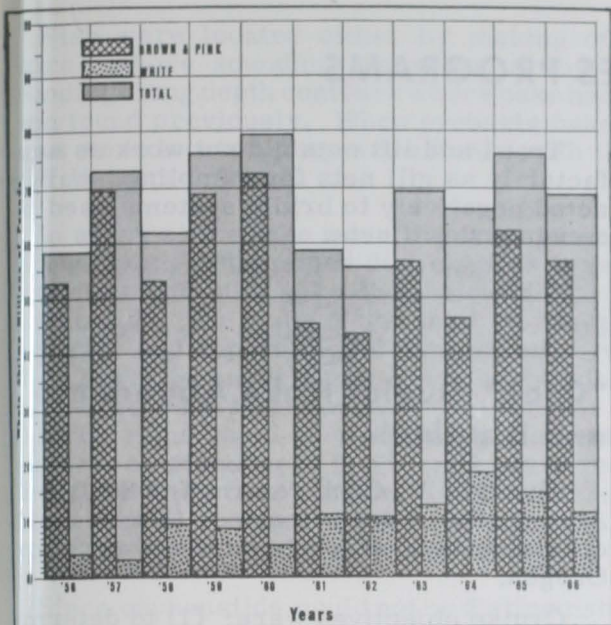


Fig. 2 - Texas shrimp landings, 1956-1966.

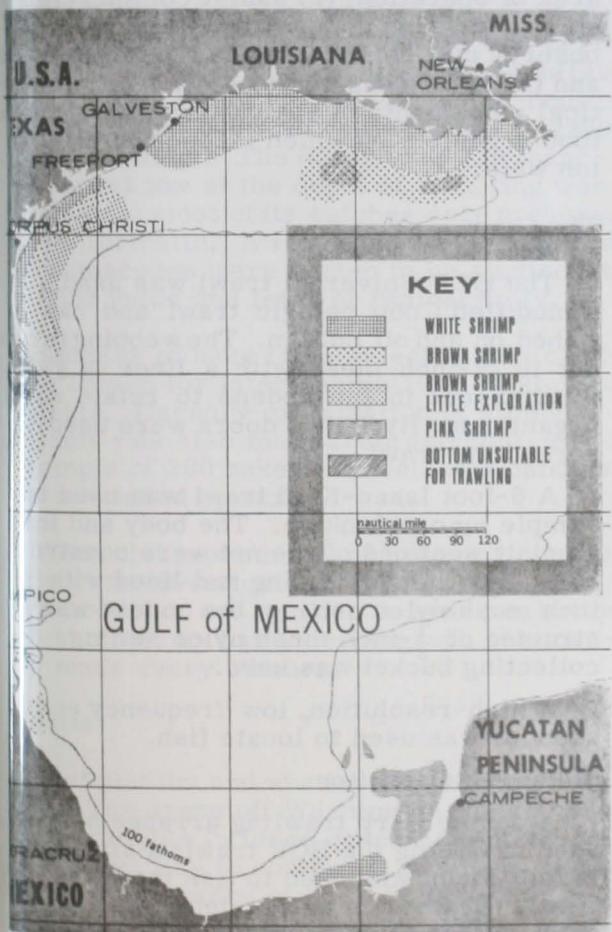


Fig. 3 - Shrimping areas of the Western Gulf of Mexico (after Aldebrand).

Shrimping Grounds

Brown shrimp are caught all year in the Gulf. The area from the Colorado River to Sebree Bank is trawled heavily to 175 feet, but shrimping between Freeport and Sabine Pass is limited to waters less than 100 feet deep. Most brown shrimp are taken in outside waters, but juveniles are plentiful in coastal estuaries in spring and summer-- but are protected by law.

The prime white shrimp grounds stretch from the Mississippi River west to Freeport, Texas. Best catches are made in water under 85 feet; some catches are made out to 120 feet. White shrimp reach larger sizes than brown in the bays. Whites are the mainstay of fall bay shrimping, especially along upper coast where estuaries are less salty.

Pink shrimp are fairly abundant in catches off the central and lower coast in spring and fall. Their scarcity off the upper coast may be due to lack of suitable nursery habitat. The young prefer firm bottom and protective vegetation--turtle grass or algae. The centers of commercial abundance are Florida's Dry Tortugas and Mexico's Campeche Banks.



Wisconsin

RHODE ISLAND TRAWLER TO FISH ALEWIFE IN LAKE MICHIGAN

Wisconsin has issued a license to a Rhode Island trawler to begin fishing for alewife in Lake Michigan. This will be the first time an ocean trawler has participated in the Great Lakes trawl fishery. Its experience may lead to increased efficiency in the trawl fleet.



BUREAU OF COMMERCIAL FISHERIES PROGRAMS

Electrical Field Increases Catch Rates in Lake Michigan

Comparable tests of trawl gear with and without an electrical field were recently completed aboard the exploratory research vessel "Kaho" in Lake Michigan. The tests were made by personnel of BCF's Ann Arbor Exploratory Fishing and Gear Research Base. Twenty-one experimental trawl drags were made: 10 used an electrical field in the trawl's forward part, and 11 were without an electrical field. The results showed a higher catch rate per half-hour of fishing effort for alewife, white suckers, and smelt when electrical field was used.

Using an electrical field, 931.3 pounds of alewife were taken, compared to 724.9 pounds when a nonelectrified trawl was used.

White suckers and smelt were taken with the electrical trawl at the rate of 51.9 and 26.7 pounds, respectively. The nonelectrified trawl produced only 32.7 and 7.6 pounds of white suckers and smelt.



"Cobb" Completes Saury Explorations

The John N. Cobb (Cruise 89) returned to Seattle on September 8 after a three-week saury (*Cololabis saira*) survey off the coasts of Oregon, Washington, and southern British Columbia. The gear systems used included a midwater trawl, two lift nets, and a variable mesh gill net. They were used with an 11.5 kw. blue-and-red incandescent light attraction system.

Saury at 80% of Stations

Saury were observed at more than 80 percent of the 32 stations occupied. The greatest abundance of large fish was encountered west of Destruction Island (30 miles offshore) and a lesser, but substantial, quantity 5-10 miles offshore near the 42nd parallel. Once, near Destruction Island, dense concentrations of fish were observed in the searchlight beam over a 3-4 mile area. Saury were not encountered in water temperatures higher than 18.9° Centigrade. However, no definite trend was established for saury distribution and abundance relative to lower temperatures.

Trawl and lift nets did not work as satisfactorily as gill nets for sampling; saury reacted negatively to bridle systems used on trawls and gill nets.



"Cobb" Studies Hake Abundance and Distribution

The John N. Cobb returned to Seattle in August after a 4-week cruise (No. 88) in coastal waters of Washington and northern Oregon.

Cruise objectives were: (1) to determine distribution and relative abundance of hake in area of operation; (2) assist commercial vessels in locating concentrations of hake; (3) observe diel behavior and availability of hake and (4) to investigate daily change in the vertical movements of euphausiids, the principal food organism on which it feeds in Washington waters.

The Gear

The BCF Universal trawl was used. It is a modified Cobb pelagic trawl and can be fished on and off bottom. The webbing throughout is 2½-inch mesh with a liner of ½-inch mesh placed in the codend to retain small organisms. Hydrofoil doors were used to spread the trawl.

A 6-foot Isaac-Kidd trawl was used to sample macroplankton. The body and intermediate sections of the net were constructed of 3½-inch mesh webbing and lined with ⅛-inch mesh nylon netting; the codend was constructed of ⅛-inch mesh nylon netting. No collecting bucket was used.

A high-resolution, low-frequency echosounder was used to locate fish.

Method of Operation

A double warp trawling arrangement was used in fishing the BCF trawl; a single warp arrangement was used to fish the Isaac-Kidd trawl. Depth of nets was determined by a depth-telemetry system.

Towing speed for the BCF trawl ranged from 1.2 to 2.4 knots; the Isaac-Kidd trawl 4 to 5 knots.

Fish were located either by making offshore-inshore sounding transects, or by sounding along depth contours where hake had been found previously. When probable hake signs were located, they were fished with the BCF Universal trawl.

In areas where hake were located, systematic sampling determined diel changes in vertical distribution of hake and their chief prey, euphausiids. No attempt was made to sample both hake and euphausiids during same period. When hake diel movements were investigated, hake signs were fished whenever present. When no signs could be distinguished on echo sounder, or signs were fairly well scattered throughout the water column, 3 depths were fished with BCF trawl--near bottom, mid-depth, and 10 fathoms below surface.

Since euphausiids could not be distinguished by echo sounder, 3 depths were fished (7 fathoms off bottom, mid-depth, and 5 to 10 fathoms below surface) once every 3 hours during periods of 12 and 18 hours. The 12-hour period was from 1800 Pacific Standard Time (evening) to 0600 hours (morning); the 18-hour period was from 0400 hours (morning) to 2200 hours (evening). The duration of the Isaac-Kidd trawl tow at the depth of sampling was 15 minutes; most of its catches were preserved in 10% formalin. A few catches of euphausiids and cumaceans were frozen to be studied later for food value and level of radioactivity.

Samples of hake from selected hake catches were frozen for later examination of stomach contents. cursory examination of stomach contents was also made from selected catches. A sample of 200 hake from selected catches was measured by sex.

When diel movements of hake and euphausiids were investigated, a profile of the temperature from sea surface to near sea bottom was obtained by bathythermograph cast usually made every 3 hours.

Results

Distribution and availability of Pacific hake: The areas off Washington where hake were available in large quantities were: (1) off Willapa Bay to southwest of Grays Harbor over bottom depths of 33 to 52 fathoms; (2) north of Grays Harbor to Queets River (24-52 fathoms); and (3) between La Push and Destruction Island (29-40 fathoms). (See figure 1.)

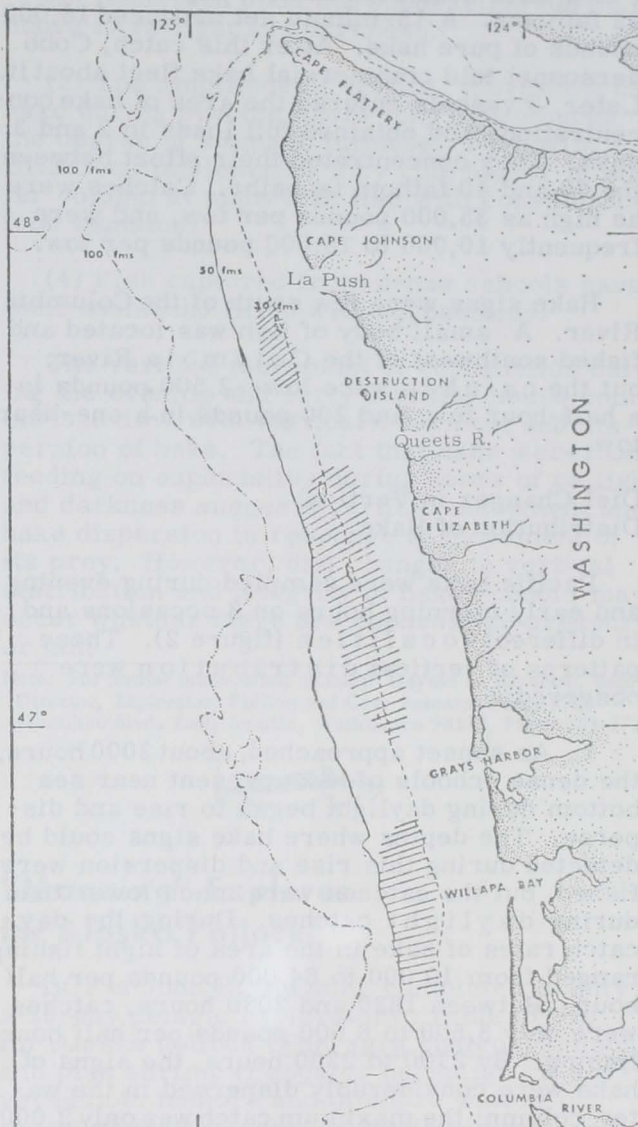


Fig. 1 - Localities where hake were found in large schools (slanted lines) and where diel changes in the vertical distribution of the hake were investigated (darkened areas).

The commercial hake fleet located hake in the first two areas. In the third, the Cobb located fish which were fished later by commercial boats. When first located, the school off La Push was only $1\frac{1}{2}$ miles long in a narrow band over bottom depths of 29 to 32 fathoms. A half-hour set yielded 10,000 pounds of hake. The Cobb watched the La Push school for the remainder of the day and resumed fishing in the evening. Next morning, the signs of hake were few and a search for the main body of fish was made. The school was relocated about 1 mile south of the previous day's position. By then the school had increased. It was about $4\frac{1}{2}$ miles long and about

$\frac{3}{4}$ of a mile wide over bottom depths of 29 to 32 fathoms. A 15-minute set produced 16,000 pounds of pure hake. After this catch, Cobb personnel told commercial hake fleet about it. Later, 3 vessels entered the area of hake concentrations and obtained full loads in 2 and 3 days. They concentrated their effort between the 30 and 40 fathom isobaths. Catches were as high as 35,000 pounds per tow, and were frequently 10,000 to 15,000 pounds per tow.

Hake signs were few south of the Columbia River. A small body of fish was located and fished southwest of the Columbia River, but the catches were low--2,500 pounds in a half-hour tow, and 200 pounds in a one-hour tow.

Diel Changes in Vertical Distribution of Hake

Pacific hake were sampled during evening and early morning hours on 3 occasions and in different localities (figure 2). These patterns of vertical distribution were observed:

1. As sunset approached, about 2000 hours, the dense schools of hake present near sea bottom during daylight began to rise and disperse. The depths where hake signs could be detected during this rise and dispersion were fished, but the catches were much lower than during daylight catches. During the day, catch rates of hake in the area of night fishing ranged from 10,000 to 64,000 pounds per half hour. Between 1830 and 2030 hours, catches were only 3,500 to 6,000 pounds per half hour fishing. By 2100 to 2300 hours, the signs of hake were considerably dispersed in the water column; the maximum catch was only 2,000 pounds in a half hour.

Maximum dispersion appears to occur during midnight hours. It is reflected in scattered signs on echo sounder and low catches at the three fishing depths: near the surface at 10 fathoms, maximum of 90 per half hour; mid-depth, 60; and near sea bottom, 64.

2. As sunrise approaches, about 0500, hake begin to descend and regroup. By 0700, they have resumed schooling near the sea bottom. However, during each night and early morning sampling period, signs of hake in early morning had greatly decreased compared to previous evening. This is also reflected in smaller catches in morning hours compared to previous evening's catches. The maximum catch

between 0200 and 0600 was 241 individuals (about 500 pounds) in one-half hour. The behavior of the school off La Push as described in "Results" (p. 25) suggests this possibility.

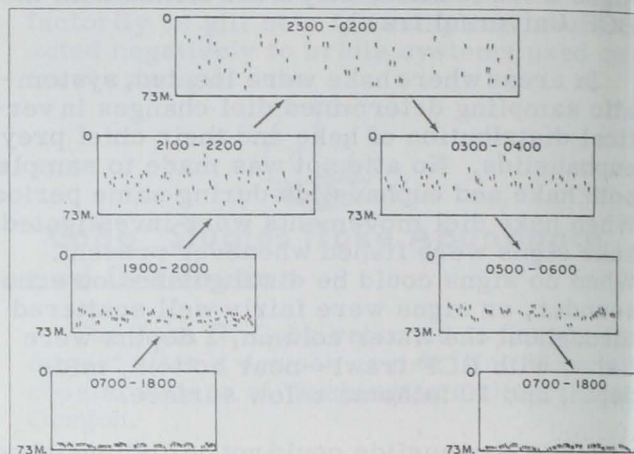


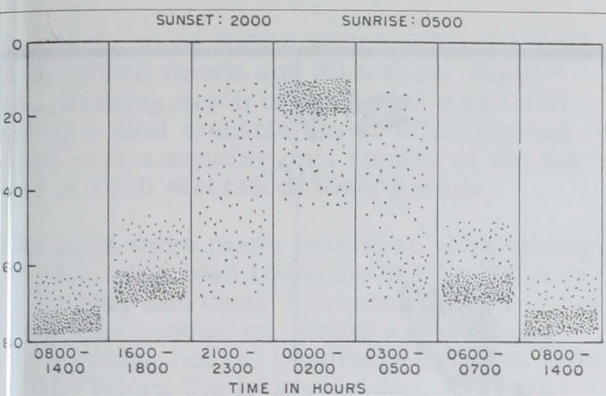
Fig. 2 - Generalized view of the diel changes in the vertical distribution of hake. Hake signs are presented as they would appear on an echo sounder. Depth presented in meters (73 meters=40 fathoms).

Figure 2 gives a generalized picture of diel changes in vertical distribution of the hake. Variations occur as observed during past surveys when hake were found a considerable distance (10 to 20 fathoms) off sea bottom during daylight hours. Also, hake possibly may undergo less dispersion and vertical ascent in late evening and midnight hours as depicted in figure 2. From study of feeding habits, there is some suggestion that hake which have their stomachs partially filled with food in the evening hours, may not ascend as high in the water column as hake with empty or almost empty stomachs. If majority of hake school are well fed, vertical ascent and dispersion may not be too great.

Diel Changes in Euphausiids' Vertical Distribution

Euphausiids were sampled on 3 occasions off Queets River south to Cape Elizabeth, over bottom depths of about 44 and 52 fathoms. A complete analysis of the Isaac-Kidd trawl catches during these samplings have yet to be made, so only a generalized picture of the euphausiids' vertical distribution can be presented now (figure 3).

During daylight hours (0800 to 1400) no euphausiids were collected from near-surface tows (7-8 fathoms) nor from tows at mid-depth, but small catches ($\frac{1}{4}$ to $1\frac{1}{2}$ pounds) were



3 - Generalized view of the diel changes in the vertical distribution of the euphausiid, *Thysanoessa spinifera*.

ken in tows near sea bottom. After 1800, euphausiids were collected during tows at all depth levels. Largest catches were taken about 1800 and between 0000 to 0230 hours. At 1800 hours, about 20 pounds were taken in the near-bottom tow. Shortly after 1800, catches from tows at mid-depth and near surface were less than 2 pounds. The large catches (about 10 pounds) made during 0000 to 0200 were from tows near surface. Catches from tows at mid-depth and near sea bottom during same period were 2 pounds or less. At other periods of the evening, 2100 to 2300, and morning (0300 to 0500), catches from near surface and mid-depth were about comparable, but tows near sea bottom caught less than tows higher up. Only a few euphausiids were identified from each catch; in every instance, they were identified as *Thysanoessa spinifera*.

In general, it appears that the euphausiids are found near the sea bottom during the daylight hours. After 1800 there is a movement of the euphausiids off the bottom to near surface waters. They appear to reach their greatest density during the hours of darkness near the surface after midnight. After 0200 the euphausiids begin their descent and by 0600 are concentrated near the sea bottom again.

Feeding Habits of Hake

Although a detailed analysis of the stomach contents of hake has not been completed, a cursory examination during the cruise suggests:

(1) Euphausiids appear to be dominant food organisms of hake in Washington coastal waters during cruise period.

(2) Hake feed upon the euphausiids during hours of twilight and darkness.

(3) The amplitude of vertical movement of hake during evening hours may depend upon the degree of stomach fullness. Fish with little food in stomachs may rise higher in water column at night than fish with considerable food remains.

(4) Fish captured from dense schools have their stomachs filled with euphausiids.

The vertical movement of euphausiids during the evening and early morning hours coincides in time with vertical movement and dispersion of hake. The fact that hake were found feeding on euphausiids during hours of twilight and darkness suggests vertical movement and hake dispersion is response to movement of its prey. However, diel changes in vertical distribution and integrity of hake schools may occur whether there are euphausiids present or not.

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



"Manning" Explores for Alaska Pollock

BCF's John R. Manning completed in July a 26-day pelagic exploratory cruise (67-2) for Alaska pollock (*Theragra chalcogrammus*) and pink shrimp (*Pandalus borealis*). It surveyed both inshore and offshore waters off the southeastern coast of Kodiak Island, and offshore waters of the southeastern Bering Sea between and due north of Umnak Island and Port Moller.

The cruises primary objectives were: (1) to gain information on species composition of midwater echo-traces observed in waters adjacent to Kodiak Island; the information would determine if commercially interesting species of shrimp occupied this layer, and (2) to obtain data on the availability of Alaska pollock to the 648 Cobb pelagic trawl.

2 Trawl Models

Sampling gear consisted of two models of midwater trawls: the 648 Cobb pelagic and a smaller version, the Cobb anchovy trawl No. 1.

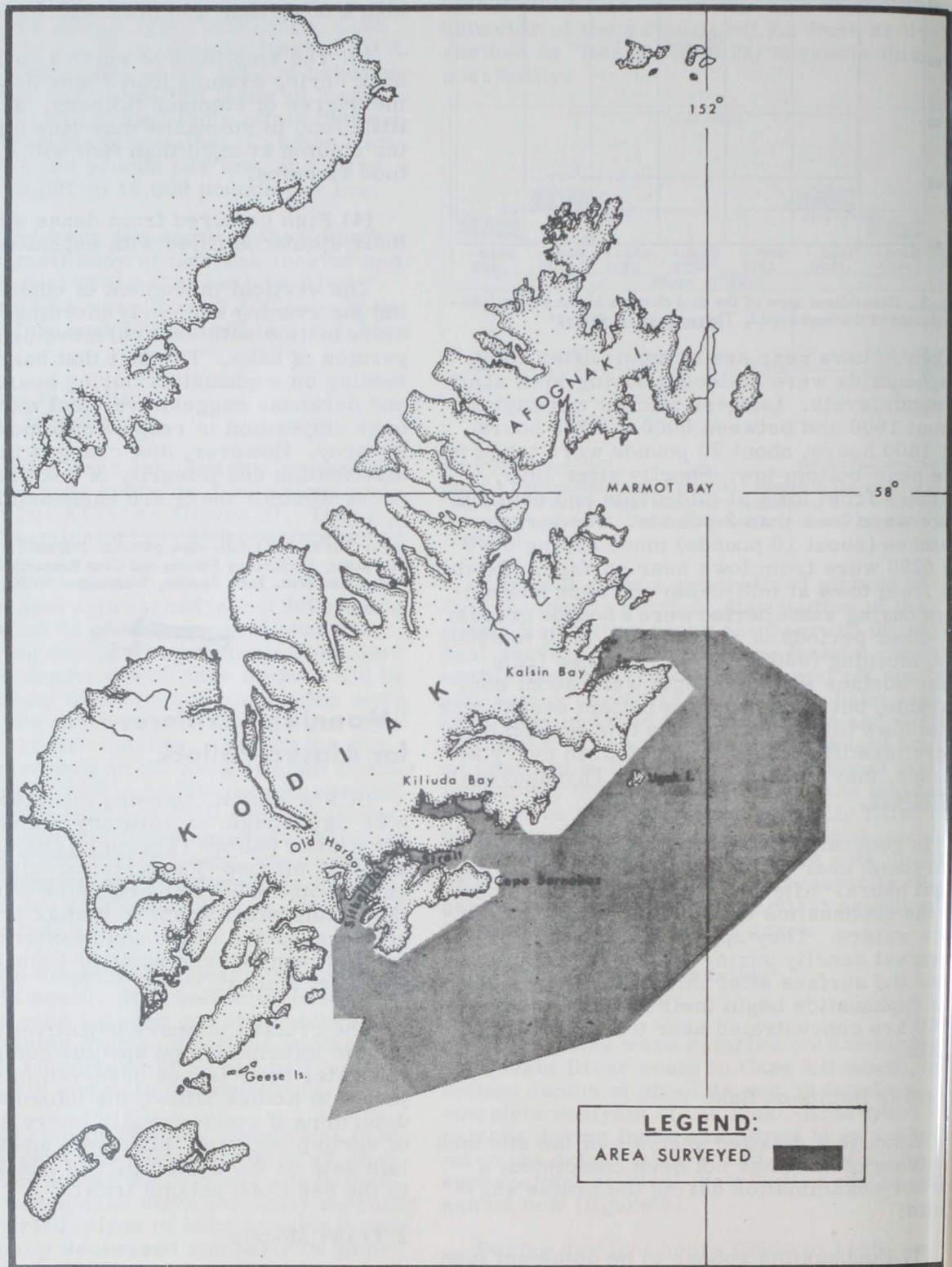


Fig. 1 - Eastern survey area.

th trawls were fished with a pair of aluminum hydrofoil doors and 30 fathom dandy-ropes. Fishing depth of the trawl was monitored by a dual electric depth-telemetering system with a sensing unit housed at the terminus of each electrical towing warp.

Six tows were made with the Cobb anchovy trawl No. 1 (on loan from the Seattle Exploratory Fishing and Gear Research Base). Trawling was conducted during evening and early morning hours, generally between 1700 and 0900 hours the following day. Both inshore (i.e., bays and straits) and offshore areas were surveyed; the majority of inshore survey time was spent in Sitkalidak Strait. Surveys offshore extended to about 30 miles east of shore. Onshore-offshore sounding transects were made at oblique angles to shore, between the 25 and 92 fathom depth contours.

Cruise Results

Midwater echo-traces indicative of possible pink shrimp concentrations were not observed in any offshore area surveyed, but they were observed in most inshore waters. Catch composition analysis of the five tows made in inshore waters showed pink shrimp the dominant species.

No commercial-size catches of pink shrimp were made. The largest catch, 710 pounds, (Haul No. 2, 775 pounds total) was captured during a 60-minute tow (intersection of Sitkalidak Strait and Kiliuda Bay). It was made through fair-to-good echo-traces between 25 and 40 fathoms over average bottom depth of 62 fathoms.

The single offshore tow (Haul No. 4, 12 miles ESE Cape Barnabus) captured 1,050

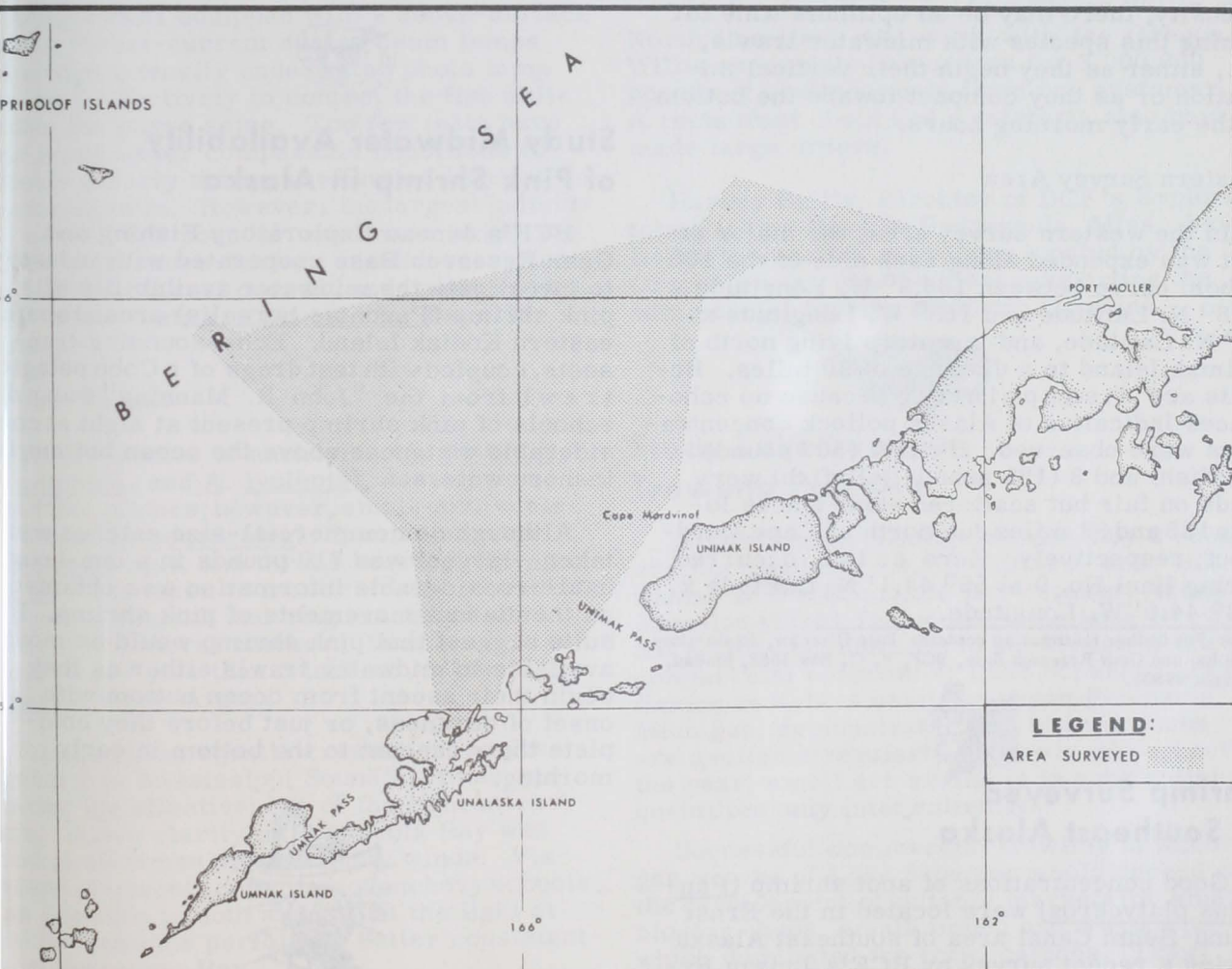


Fig. 2 - Western survey area.

pounds of small Alaska pollock (\bar{x} 31 cm.). Strong echo-traces observed during this tow extended to maximum height of 12 fathoms from bottom, with bottom depth ranging between 68 and 73 fathoms. Recordings showed the school to be quite small, consisting of several small isolated nodules lying within a distance of one-quarter mile.

What Results Suggest

Results of catch composition analysis and echo-gram observations suggest that pink shrimp experience a daytime migration and are negatively phototropic (taking a particular direction under influence of light). A constant fathometer gain was used throughout the in-shore survey area to help reduce problems associated with interpreting relative densities of echo-traces. If the results noted are representative of pink shrimp responses to light intensity, there may be an optimum time for fishing this species with midwater trawls, i.e., either as they begin their vertical migration or as they compact toward the bottom in the early morning hours.

Western Survey Area

In the western survey area, the major effort was expended along each side of the 100-fathom curve between 166.5° W. Longitude x 54.8° N. Latitude and 169° W. Longitude x 56° N. Latitude, and in waters lying north of Unimak Island to a distance of 90 miles. Results are disappointing because no echo-traces indicative of Alaska pollock concentrations were observed. Hauls 7 (500 pounds jellyfish) and 8 (125 pounds jellyfish) were made on fair but scattered echo-traces located 35 and 33 miles due north of Cape Mordvinof, respectively. Zero catch occurred during Haul No. 9 at $55^{\circ} 44.1'$ N. Latitude x $168^{\circ} 44.0'$ W. Longitude.

Note: For further information contact: Base Director, Exploratory Fishing and Gear Research Base, BCF, P. O. Box 1668, Juneau, Alaska 99801.



Shrimp Surveyed in Southeast Alaska

Good concentrations of spot shrimp (*Pandalus platyceros*) were located in the Ernst Sound-Behm Canal area of southeast Alaska during a recent survey by BCF's Juneau Exploratory Fishing and Gear Research Base. The optimum soaking time for shrimp pots

and shrimp bait preference also were investigated. Short soaking times were found to be most effective; seal meat proved superior as bait to herring, pet food, and salmon tails.

Trawls Prove Ineffective

BCF cooperated with a commercial trawler this summer to test the effectiveness of trawls for catching spot shrimp (*Pandalus platyceros*). Participating were personnel from BCF's Juneau and Seattle Exploratory Fishing and Gear Research Bases.

Midwater and conventional bottom trawls equipped with BCF-supplied depth-telemetry systems were fished by the trawler for 30 days in areas of Southeastern Alaska where spot shrimp were known to be abundant. Results indicated that trawls would not catch spot shrimp in commercial quantities.



Study Midwater Availability of Pink Shrimp in Alaska

BCF's Juneau Exploratory Fishing and Gear Research Base cooperated with industry to investigate the midwater availability of pink shrimp (*Pandalus borealis*) around southeastern Kodiak Island. Echo-sounding transects, coupled with test drags of a Cobb pelagic trawl from the "John R. Manning" found schools of pink shrimp present at night at considerable distances above the ocean bottom in inshore waters.

Although no commercial-size catches were taken--largest was 710 pounds in a one-hour haul--considerable information was obtained on the diurnal movements of pink shrimp. Results suggest that pink shrimp would be most available to midwater trawls either as they begin their ascent from ocean bottom with onset of darkness, or just before they complete their descent to the bottom in early morning.



Bowers' Studies Use Lights to Attract Anchovy

The R/V George M. Bowers cruised Mississippi Sound and Pensacola Bay to determine the effectiveness of a small-mesh purse net for catching anchovies attracted to various types of above-surface and subsurface lights. (Cruise 80, ended Aug. 1.)

A variety of light attractors was used: a lamp incandescent bank (13,500 watts), a 100-watt incandescent cluster, both systems use alternating current; a 500-watt 28-volt direct current underwater incandescent light; a 1,000-watt alternating current underwater quartz iodide light; and 3,250-watt alternating current above-surface mercury vapor lights.

A light skiff equipped with 2 above-surface 28-volt direct-current sealed beam lamps and a high intensity underwater photo lamp was used effectively to control the fish while trawling the purse seine. Too few tests have been made under comparable conditions to indicate clearly the most effective light-attractor system. However, the largest individual catch (830 pounds) was made using the 500-watt above-surface incandescent and the 500-watt direct current underwater system. More tests are planned for the next cruise.

Species Caught

Three species of anchovies (*A. hepsetus*, *A. mitchilli*, and *A. lyolepis*), usually dominated the catches; however, small-size scaled sardines (*H. pensacolae*), Spanish sardine (*Sardinella* sp.), and thread herring (*O. ogumum*) were taken in most catches. Juvenile and young Spanish and king mackerel were present in several catches. Most anchovies caught were less than 3 inches. A few of *A. hepsetus* were larger.

Summertime squalls created excessive turbidity in Mississippi Sound at times and limited the effectiveness of the light attractors. Water clarity in Pensacola Bay was good at all times despite gusty winds. Visual and electronic detection of anchovy schools was possible in both areas, but the light attractor systems performed better consistently in Pensacola Bay.

Commercial Quantities of Calico Scallops off Florida

Surveys of the exploratory fishing vessel "Oregon" off Florida have found commercial quantities (20 bushels per hour) of calico scallops. Catches by the Oregon between Vero Beach and New Smyrna Beach are ranging from 36 to 64 bushels per hour.

BCF has told the local calico scallop industry in Florida and North Carolina of the Oregon's success. Industry members will board the vessel to observe further tests with trawl gear used by the commercial fleet for taking scallops. BCF efforts are aimed at aiding the scallop industry of the Southeast coast, which has recently experienced decreased catches.

The "Criswell," owned by Elmer Willis of North Carolina, will work with the Oregon. Willis reportedly has orders for 3,000,000 pounds of scallop meats from one customer. A restaurant chain and a cafeteria also have made large orders.

Harvey Bullis, Director of BCF's Exploratory Fishing Base in Pascagoula, Miss., believes the scallop resources located by the Oregon are as vast as those supporting the commercial fishery off North Carolina.



Study Lake Superior Trawling Potential

Experimental fishing conducted by 2 cooperating trawlers, "A. E. Clifford" and "Hiawatha," in the Economic Development Administration (EDA) Technical Assistance Project has added considerably to knowledge of the commercial potential of Lake Superior. Test fishing in waters near Keweenaw Peninsula, Michigan, demonstrated that bloater chubs are available regularly to trawls throughout the year; smelt are available in substantial quantities only intermittently.

Successful commercial trawling in Michigan waters of Lake Superior would depend on the development of suitable markets for small bloater chubs, small smelt, and suckers, which dominated the trawl catches. Trawl catches in western Lake Superior, where the amount of trawlable bottom is very limited, have consisted primarily of smelt and cisco.

Echograms here suggest heavy concentrations of fishes above the lake bottom, where they are unavailable to bottom trawls. Mid-water trawls will be used this fall to determine if these fishes can be harvested profitably.

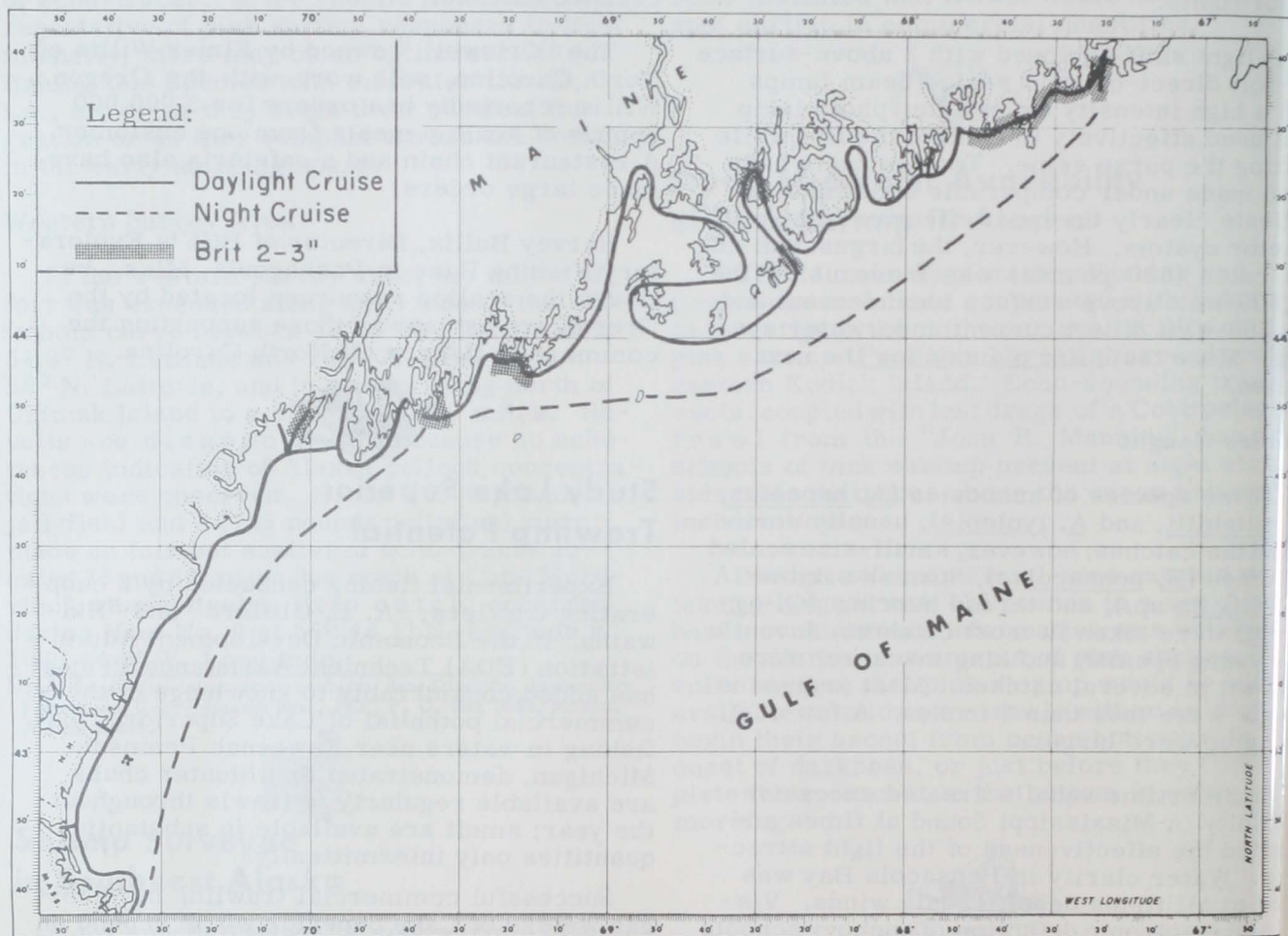


"Rorqual" Studies Summer Distribution of Small Brit

The R/V Rorqual of BCF's Biological Laboratory, Boothbay Harbor, Maine, conducted Cruise 3-67 in July to determine the summer distribution of small brit (2"-3") prior to their entry into the fishery.

Its preliminary findings: small brit (2"-3") were present only on the inshore transect. They were most numerous from Mooseabec Roach to Machias Bay, where traces were almost continuous. Concentrations also occurred in Muscongus Bay, the Sheepscot, and Damariscotta areas. No herring were observed from Sheepscot Bay to Cape Ann, except for a few taken in Casco Bay.

The Rorqual's area of operations was Cape Ann to Machias Bay, inshore to 5 fathoms and offshore to 50 fathoms. Measurements of salinity and temperature were made. The thermograph was run continuously. Surveys were made with an echo sounder, and traces were sampled with a high-speed trawl and a shrimp try net.



M/V Rorqual (Cruise 3-67).



BCF Honolulu Aids Skipjack Tuna Industry

The aku fishery is the chief U. S. fishery in the central Pacific Ocean. Aku is the Hawaiian name for skipjack tuna. About 10 million pounds of this valuable food fish are caught each year. Although the Hawaiian resource is large, the industry has failed for several years to keep pace with the expanding U. S. economy. The fishing vessels are fewer and the number of fishermen decreasing.

To strengthen this industry, representatives of the State of Hawaii, the U. S., and the industry have joined to coordinate long- and short-term research on the central Pacific fishery problems.

John C. Marr, Director, Hawaii Area, BCF, says the major goal of research on skipjack tuna at BCF's Biological Laboratory in Honolulu is to increase the catch substantially--not only near Hawaii but in adjacent waters of the central Pacific. But the laboratory and other research agencies also face the shorter range problem of aiding the present Hawaiian fleet.

Industry Is 2 Separate Fisheries

The skipjack tuna fishery consists of two separate fisheries: for skipjack tuna itself and for nehu, the little anchovy used as live bait. The skipjack tuna is caught by pole and line. Schools are attracted to the vessel by tossing handfuls of nehu overboard.

At present, each vessel fishes for its own bait and takes about 20 buckets (160 lbs.) of nehu for each trip. Studies show that a lot of time is spent fishing for bait that could be spent fishing for skipjack tuna. Director Marr believes this added time would produce a large increase in the total tuna catch.

The Honolulu lab is attacking the problems of obtaining bait in two ways. The first is by investigating the possibility of taking bait in stationary traps and nets. The ultimate aim here is to prove the feasibility of a small, independent, bait-catching industry. The second way is by studying other small fishes as supplements or substitutes for the nehu.

Weir and Lift Nets Built

In a project partially supported by Hawaii, personnel of the lab's Fishery Development

Program constructed an experimental weir and a night lift net and installed them in Kaneohe Bay, on the windward side of Oahu. The bay is one of the chief sources of nehu for the skipjack tuna fleet.

The heart-shaped weir, about 450 feet around, extends from shore into water about 10 feet deep. The baitfish are collected at night. A light attracts them into a small pocket at the tip of the weir. Richard S. Shomura, who heads the project, says results of the first weeks of operation have been encouraging. The lowest catch was less than 1 bucket of bait, but most have been larger; one reached 78 buckets. Another weir is under construction. Results with the lift net have been less successful; the largest catch was 16 buckets.

Seek Alternate Bait Species

Alternate bait species have been tried in the Hawaiian fishery before. Now a new approach is being used. The behavioral characteristics of the nehu--which makes it so attractive to the skipjack tuna--have been studied. Knowing some of these characteristics, the scientists have been seeking other small fishes that equal or exceed the nehu. Several kinds have been tried. Some have been imported from mainland U. S., others from Southeast Asia.

Some of this work is done in shoreside tanks, some at sea. In the tanks, the behavior of the nehu and other prey fish has been observed in the presence of a predator, usually the kawakawa, a close relative of the skipjack tuna.

At sea, scientists have donned diving gear to study the behavior of the bait species and the tunas under actual fishing conditions. Using scuba, they have measured the diving rates of the baitfish and observed other aspects of their behavior. John J. Magnuson, head of the lab's behavior studies, says films also have been taken and are expected to provide quantifiable data on baitfish behavior.

The most promising alternate species so far is the threadfin shad, a fresh water fish introduced into Hawaii about a decade ago. The shad has naturalized itself in Hawaii. Other species are still being studied.

Operations Analysis of Fishing

The program to aid the industry includes an operations analysis of fishing activities. The captains of the fleet have cooperated. During the summer of 1967, for the first time, trained observers were stationed aboard several fishing sampans and recorded every aspect of the fishing operation--from the time the vessels left port until the catch was unloaded.

The information they collected, millions of separate items, are being coded for analysis by computer. Preliminary inspection of the data shows that it will provide much new information, says Tamio Otsu, who supervised the project.

Where Does Fish Spend Its Time?

Researchers do not know where the fish spend the time they are not at the sea surface--most of their time. The laboratory's research vessel "Townsend Cromwell," equipped with a high precision sonar, spent much of summer 1967 studying this problem. The sonar gathers information on the depth a target is swimming, its direction, and its speed. So far, most targets have been located within 30 feet of the surface. There is another heavy concentration between 200 and 500 feet. Skipjack tuna schools have been tracked from the surface to the depths. More than half went deeper than 200 feet, between their sorties to the surface. Some went down to 400 feet.

The Waters Studied Too

The observers aboard the skipjack tuna sampans have been collecting information on the temperature and salinity of the waters in which tunas are caught. To add to this information, the Townsend Cromwell, in summer 1967, the height of the fishing season, collected oceanographic data both in and outside the fishing area. These data are now being analyzed. The information from fishing vessels and the Cromwell is expected to pinpoint physical and chemical characteristics of waters in which the fish are caught.

A final line of attack on the skipjack tuna problems is the application of the methods of systems analysis widely used in industrial and military planning. Brian J. Rothschild, Acting Deputy Area Director, BCF, Hawaii,

says the object of such a study is to design an economically feasible plan for the operation of the Hawaii-based fishery for tunas. It would be one healthy enough to stimulate investors to put their money into it.



"Delaware" Studies Herring and Lobster Offshore Populations

The M/V Delaware of BCF's Biological Laboratory at Boothbay Harbor, Maine, cruised the northern part of Georges Bank and Lydonia Canyon, September 6-15 (Cruise 67-6).

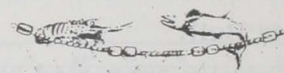
The cruise, hampered by bad weather, had 3 purposes: to sample populations of sea herring and lobsters and to obtain related environmental data; to obtain blood samples from lobsters; and to make plankton tows for larval herring.

Fishing Operations

To sample herring population, 18 trawl sets were made. The sets, of 1 hour duration, were made in 26 to 53 fathoms and yielded 19 bushels (approximately 1,400 pounds). The herring obtained were 21.7 to 36.5 cm. long. The 1960- and 1961-year classes were dominant in the catches, followed in percentage occurrence by fish of the 1959-year class and older. Shipboard examination indicated the majority were in stage V of gonadal condition. To sample lobster population, 5 trawl sets were made at Lydonia Canyon in water from 55 to 120 fathoms. They yielded 18 lobsters (44% females and 56% males). Only 1 lobster was berried.

Plankton Operations

Thirteen 1-meter net plankton tows of 10 minutes duration (5 minutes at 20 meters, 5 minutes at 10 meters, and 5 meters at surface), were made. No larval herring were obtained.



"Geronimo" Cruises Entire Gulf of Mexico in Late Winter

By Reed S. Armstrong and John R. Grady*

BCF's R/V Geronimo, Galveston, Texas, has completed the first in a series of hydrographic surveys of the Gulf of Mexico (Cruise 1). The immediate purposes of these surveys are to describe the circulation and stratification in the Gulf of Mexico and to analyze the time variations of Gulf waters. Additional long-range goals are to relate the state of variations in the waters to the driving force (the atmospheric circulation), and to predict the circulations and characteristics of the waters. We intend to occupy about 135 hydrographic stations, sampling from the surface to the bottom, over all the Gulf during each cruise. Bathythermograph casts--and standard meteorological observations and radiation measurements for heat budget analyses--are made routinely along the cruise route.

During this first "all Gulf" cruise (Feb. 1-April 1, 1967), continuing problems with the ship's navigational gear curtailed operations in the eastern Gulf, but the cruise plan was rearranged to accomplish a rather comprehensive survey of the entire Gulf. We occupied 114 hydrographic stations and collected surface salinity samples and made bathythermograph casts at 281 stations.

We had planned to make vertical plankton hauls to 100-m. depth with a $\frac{3}{4}$ -m. Hansen net at each hydrographic station--and to make vertical plankton hauls to near the bottom in the deeps of the Gulf with a Gulf V sampling net. Because of almost continuously poor weather and high seas, only 87 shallow and 2 deep plankton hauls were made.

This cruise was very successful, particularly because it was only the second time the entire Gulf of Mexico has been surveyed during one cruise operation. (The first was by the R/V "Hidalgo" of Texas A & M University Feb.-March 1962.)

As the data are processed and analyzed, numerous interesting features of the Gulf waters are noted in surface distribution of the various water properties.

The circulation pattern of the surface waters can be inferred from the surface tem-

perature distribution (fig. 1). Warm water (more than 24° C.) from the Caribbean Sea is the main driving force for the circulation throughout most of the Gulf. The water enters the Gulf along the western side of the Yucatan Straits and streams north to about 28° N. latitude. It then turns sharply to the south and, after following a rather intricate path, leaves the Gulf through the Florida Straits.

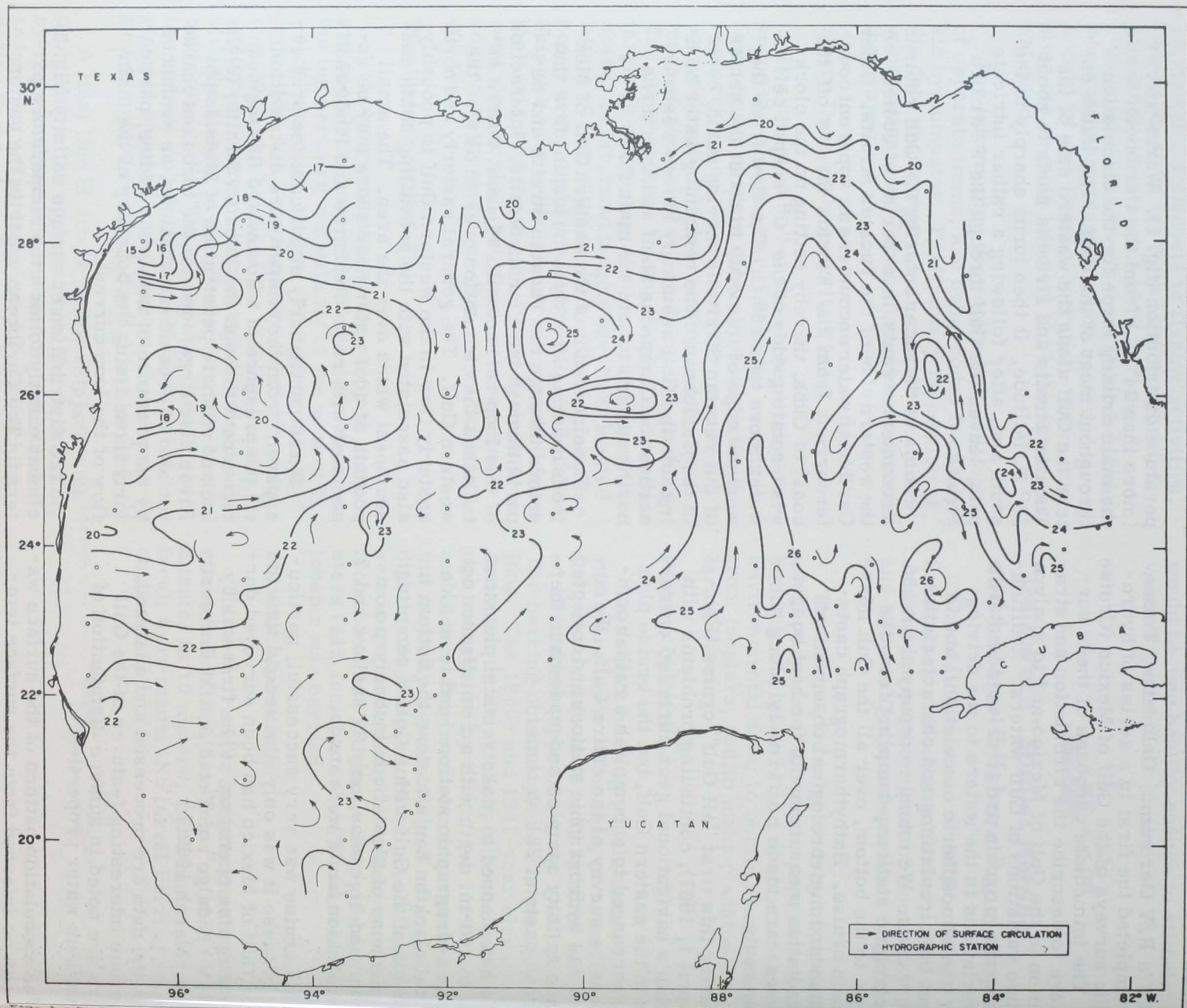
Some of the water entering the Gulf returns as countercurrents, in a series of eddies, on the western side of the Yucatan Straits. Other Caribbean water encounters an apparent countercurrent from the Florida Straits off the coast of Cuba, thereby setting up the clockwise-rotating eddy of the "C"-shaped cell of water more than 26° C. The flow from the western edge of this eddy to about the center of the Yucatan Straits is moving south, back in the Caribbean. The remaining water coming into the Gulf seemingly moves westward across the Campeche Shelf and then turns northeastward to join the main flow.

The circulation of the eastern Gulf of Mexico is reacting directly to the looping flow that enters through the Yucatan Straits and departs through the Florida Straits. Interaction of this loop current with adjacent waters establishes the circulation over most of the western Gulf. The general easterly and north-easterly flow in the western Gulf is probably also associated with the prevailing south and southeast winds over the area. The small pockets of cool water near shore may be associated with river discharge and land runoff.

Three particularly significant features are apparent from the temperature distribution: (1) the presence of a southward flowing countercurrent through the Yucatan Straits; (2) the lack of offshore penetration of Mississippi River discharge; and (3) the turbulent characteristic of oceanic circulations, as evidenced by the presence of numerous eddies, particularly those lining the boundary of the main flow of the loop current.

The distribution of surface salinity (fig. 2) almost exactly follows the temperature patterns. The Caribbean water in the eastern

*Research Oceanographers, BCF Biological Laboratory, Galveston, Texas.



...ated pattern of the surface circulation from Cruise 48 of the R/V Corrimo (February to April

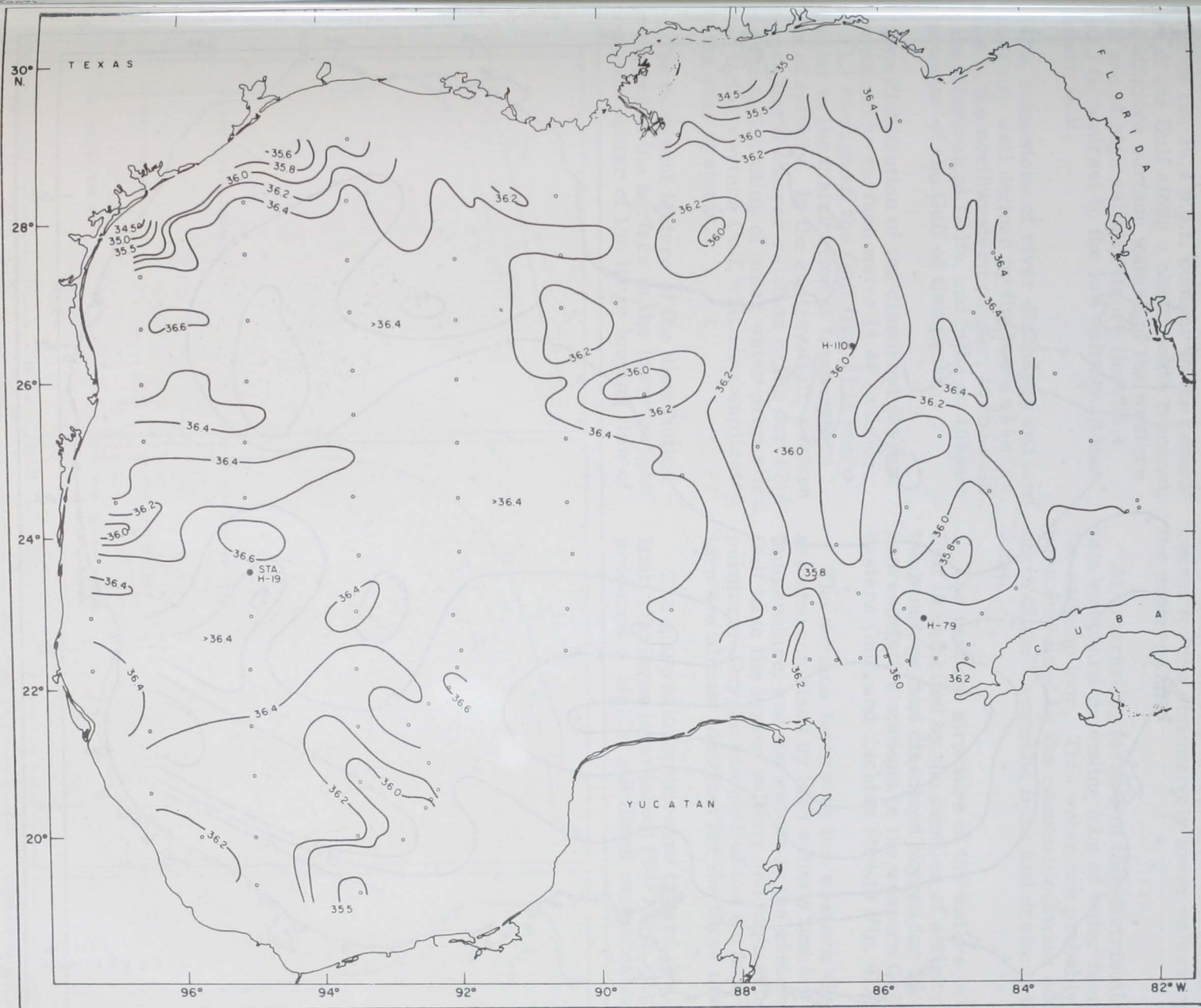
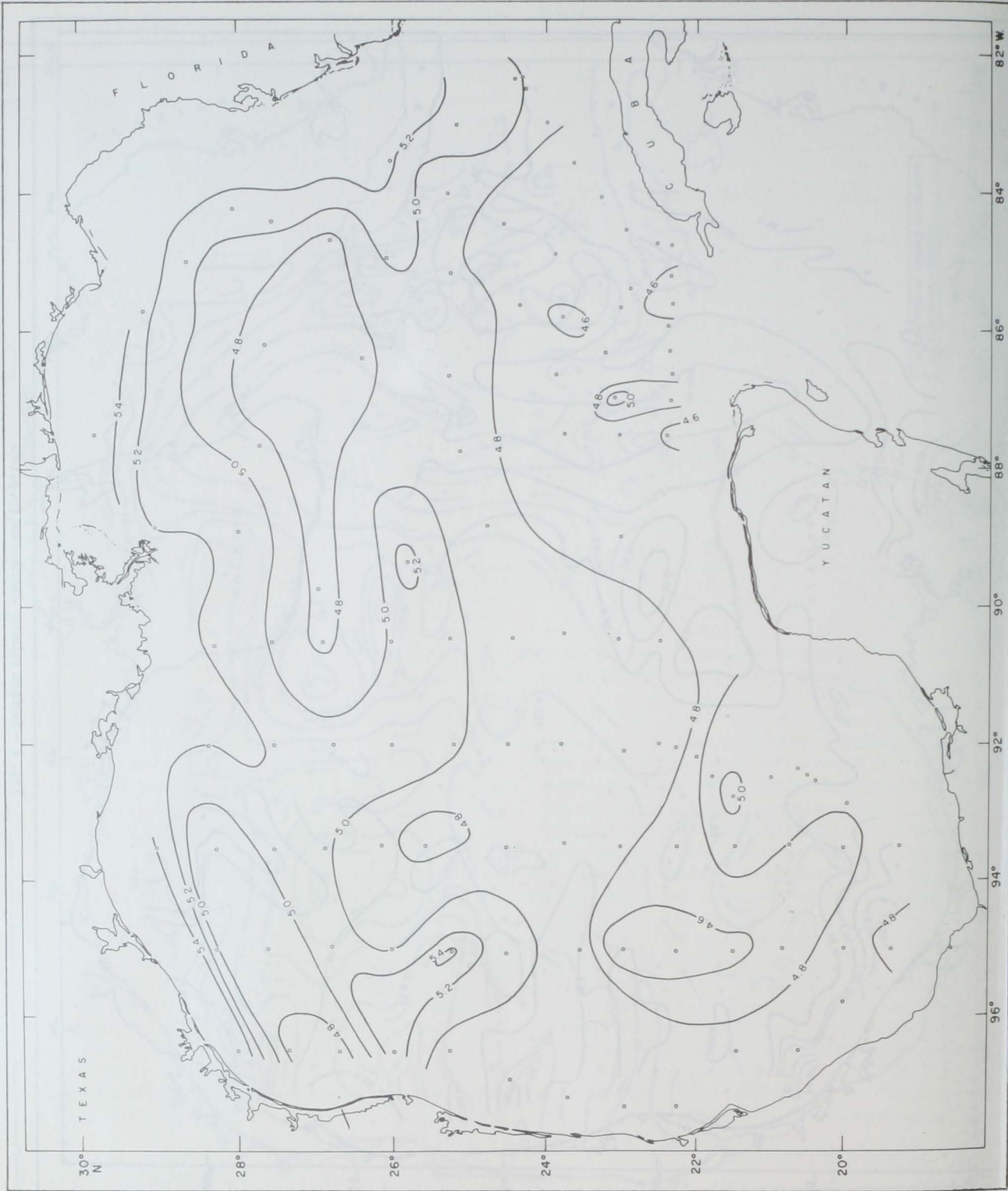


Fig. 2 - Surface salinity distribution (p.p.t.).



Gulf is easily distinguished by its low salinity; 36 parts per thousand (p.p.t.). The rather direct influence of the loop current is delineated by the 36.4 p.p.t. contour in the central part of the Gulf along a north-south transect. The offshore surface waters of the western Gulf are of high salinity (more than 36.4 p.p.t.) in contrast to the low salinity in the eastern Gulf.

The extensions of river discharge and land runoff are well defined by the low-salinity cells in the northwestern corner, to the east of the Mississippi Delta, and in the southeastern sector of the Gulf of Campeche.

The distribution of the dissolved oxygen content of the surface water (4.40 to 5.55 ml./l.) throughout the Gulf (fig. 3) is more similar to the distribution of temperature than of salinity. In the eastern Gulf, surface oxygen has a clearer relation to the currents and the distribution of other water properties than in the western Gulf, which is complicated by the eddy systems.

The dominant feature of the distribution of oxygen at the surface is the lower oxygen content of water of the large looping flow of

the eastern Gulf. The relatively low oxygen content of the water entering the Gulf through the Yucatan Straits (about 4.48 ml./l.) accounts for the distinctively lower values in the eastern Gulf.

An interesting feature of this distribution is a westward-extending lobe of water from the eastern loop. This water has probably been entrained by the counterclockwise eddy north of the Campeche Bank and drawn to the west.

The vertical structure of the waters in the Gulf is exhibited by the profiles of salinity, temperature, and dissolved oxygen for three representative stations in the western Gulf, eastern Gulf, and Yucatan Straits (fig. 4).

The surface layers in the western Gulf are characterized by high salinity and low temperature, and the waters in the eastern Gulf have the lowest salinity and highest temperature. Oxygen contents of the surface waters are almost identical for the three areas.

The sharp salinity increase toward the salinity maximum layer (about 100-200 m. depth) produces a highly stabilized stratification.

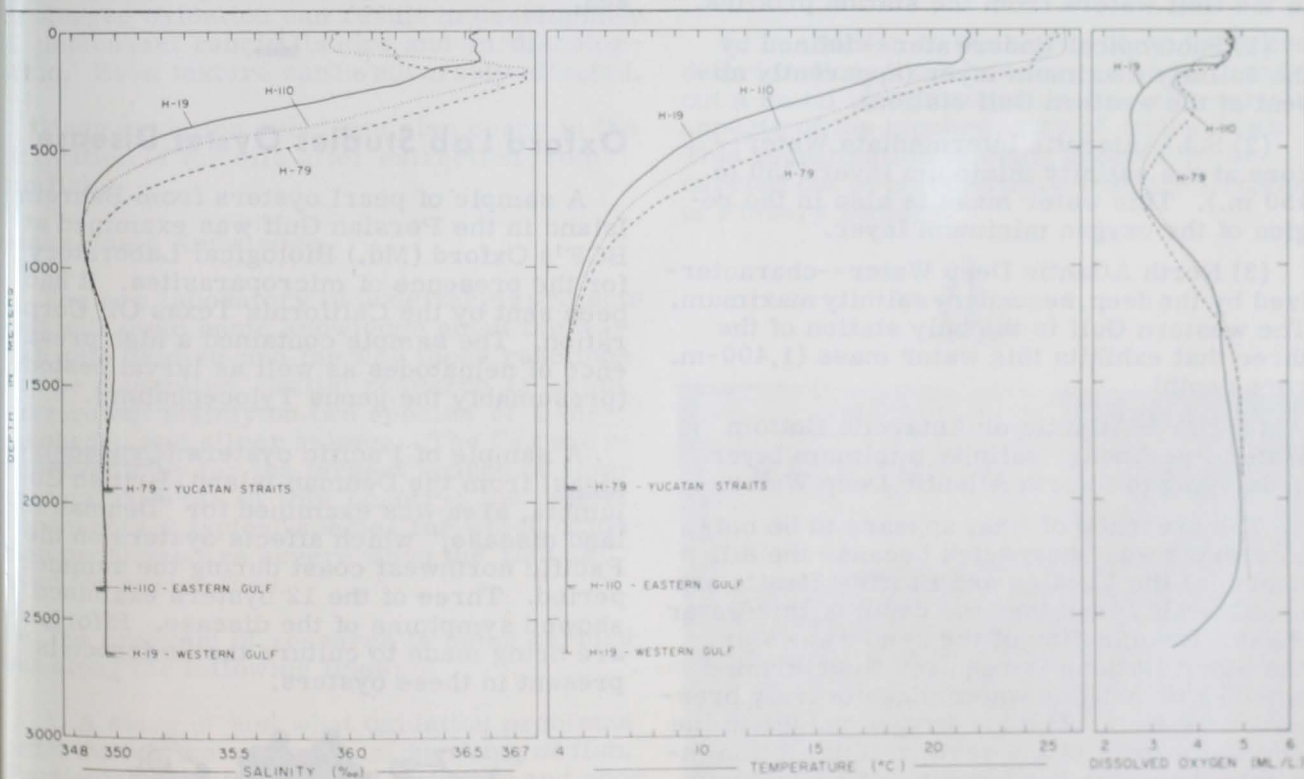


Fig. 4 - Vertical profiles of salinity (p.p.t.), temperature ($^{\circ}$ C.), and dissolved oxygen (ml./l.) representative of major marine areas of the Gulf of Mexico. See fig. 2 for station locations.

Because the high salinity water within and below this layer cannot come in contact with the air, the decrease in oxygen is pronounced through the layer. The western Gulf station has no significant subsurface salinity maximum, but a strong temperature gradient exists (about 150 m.), which has the same effect on stability.

The following points, apparent from the vertical profiles, help to interpret the surface circulations.

(1) In the western Gulf:

(a) If water is upwelling (as with a counterclockwise curving flow--surface divergence), low-temperature, low-salinity water is brought toward the surface.

(b) With convergent flow, warm, high-salinity water is collected.

(2) In the eastern Gulf:

(a) Surface divergence brings high-salinity, low-temperature water to the surface.

(b) Surface convergence acts to collect the low-salinity, warm water.

As many as four water masses are evident in the Gulf waters from the station profiles.

(1) Subtropical Underwater--defined by the salinity maximum layer (apparently absent at the western Gulf station).

(2) Sub-Antarctic Intermediate Water--core at the salinity minimum layer (750 to 950 m.). This water mass is also in the region of the oxygen minimum layer.

(3) North Atlantic Deep Water--characterized by the deep, secondary salinity maximum. The western Gulf is the only station of the three that exhibits this water mass (1,400-m. core depth).

(4) North Atlantic or Antarctic Bottom Water--secondary salinity minimum layer underlying the North Atlantic Deep Water.

The presence of what appears to be bottom water was unexpected because the sill depths of the Yucatan and Florida Straits are considerably less than the depth of this water mass. Examination of the deep waters at the other stations is required to determine whether or not this water mass is truly present in the Gulf. The low oxygen values in the deepest waters of the western Gulf station indicate the water has been out of contact with the atmosphere for a considerable time.



Complete Two-Year Bottom Temperature Record off Cape Cod

On July 19 and 20, scientists of BCF's Environmental Oceanographic Research Program, Washington, D. C., made the final recovery of temperature recorders maintained for 2 years at 5 locations on the bottom off Cape Cod. The instruments, self-contained and designed to run 400 days, were recessed in 12,000-pound mooring blocks of navigation type buoys. The buoys, now retrieved, were specially established by the U. S. Coast Guard along a profile extending from 6 to 29 fathoms.

This instrument work had two objectives: (1) to obtain "continuous" temperature records with which to correlate the bathymetric ranges, times of reproduction, growth rates, etc., of benthonic (sea bottom) invertebrates along the profile, and (2) to develop a reliable method to put recording instruments on the continental shelf fishing grounds. Temperature data recovery from the 5 stations was about 80 percent during the first-year--better than usual for recording instruments at sea.



Oxford Lab Studies Oyster Disease

A sample of pearl oysters from Bahrein Island in the Persian Gulf was examined at BCF's Oxford (Md.) Biological Laboratory for the presence of microparasites. It had been sent by the California Texas Oil Corporation. The sample contained a high prevalence of nematodes as well as larval cestode (presumably the genus *Tylocephalum*).

A sample of Pacific oysters (*Crassostrea gigas*) from the Denman Island, British Columbia, area was examined for "Denman Island disease," which affects oysters on the Pacific northwest coast during the summer period. Three of the 12 oysters examined showed symptoms of the disease. Efforts are being made to culture the "microcells" present in these oysters.



Oxidative Changes Are Being Investigated at New Food Science Pioneer Research Laboratory

By Maurice E. Stansby*

The Food Science Pioneer Research Laboratory, established in July 1966 at Seattle, is conducting research primarily in the field of oxidative changes in fishery products. Although bacterial spoilage is the chief cause of the deterioration of fish, advances in refrigeration and the development of newer techniques of preservation such as irradiation and pasteurization, give promise that, before long, bacterial spoilage will be a minor problem for the fishing industry. Yet these same advances in technology of fish preservation greatly increase damage caused by oxidation. Both frozen and irradiation preservation increase rather than decrease the tendency for fish oils to oxidize.

The development of antioxidants useful for other foods has not solved this problem for fishery products because of the much greater instability of the chemical components in fish. Oxidation leads to loss of original normal flavors, leaving the fish almost tasteless. Prolonged oxidation can result in development of unpleasant rancid flavors and in discoloration. Even texture can be adversely affected.

Many oxidation problems also occur in the utilization of the oils after extraction from the fish.

Seeks Basic Knowledge

The new laboratory is undertaking projects that will yield basic knowledge about the way fish oils oxidize and the way these reactions can be controlled. Initial research is being carried out mainly on two species of fish--haden and silver salmon. The former represents by far the largest source of commercial fish oil in this country; the latter represents a typical species for which oxidation problems are severe when the fish is used for human food.

The program of research is being carried out along the following lines:

1. A study of just what oxidation problems exist during the commercial handling of fish. Particular attention is paid to flavor and odor changes.

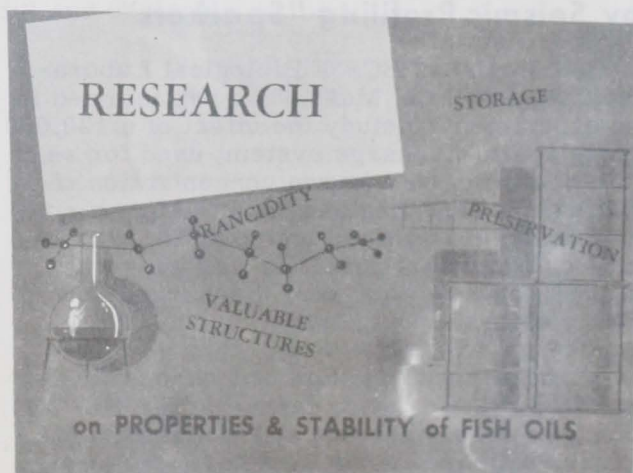
2. A study of the mechanism of oxidation of fish.

3. A study to determine what role bacteria play in oxidation of fish oils when bacterial spoilage is going on simultaneously with oxidation of the oils.

4. A study of antioxidants that are to be used with fish oil both while in fish and after extraction from the fish.

5. An investigation of the mechanism of oxidation of fish oils which have been incorporated into paint. When paint in which fish oil is incorporated dries, as a result of oxidation an undesirable change takes place simultaneously resulting in development of "fishy" odors. An investigation of the mechanisms of these two kinds of oxidation is aimed at controlling the latter at the same time permitting the desirable drying of the paint to take place.

6. In addition to the research on oxidative deterioration, the laboratory is about to carry out a small investigation dealing with certain aspects of the biochemistry of living fish. This investigation is being planned to be carried out in collaboration with the Division of Fishery Biology.



*Director, Food Science Pioneer Research Laboratory, Seattle, Washington.

Year of Acquiring Oceanographic Data is Successful

BCF's Biological Laboratory at Stanford, Calif., completed a successful year of acquiring oceanographic data through an expendable bathythermograph (XBT) system. The system was aboard the Matson Line freighter "California." Since June 1966, the system has provided temperature-depth data for 19 trips between Honolulu and San Francisco, and 2 trips between Honolulu and Los Angeles.

The XBT data are transmitted from the vessel, through BCF radio station WWD, to the Navy's Fleet Numerical Weather Facility at Monterey, Calif., for operational use. Copies of the analog records are forwarded to the Navy Electronics Laboratory for research application, and to the National Oceanographic Data Center to become records. Temperature-depth sections for each crossing are constructed at the BCF Stanford Laboratory. The resulting time-series of sections are the first of this nature ever obtained. They are being analyzed, along with studies of changes in monthly mean sea level, to establish the character of temporal fluctuations of the California Current. Such fluctuations may be significant to fisheries of that region.

This project is considered an outstanding example of successful interagency and Government-industry cooperation.



Fish Not Affected by Seismic Profiling "Sparkers"

A biologist of BCF's Biological Laboratory, Woods Hole, Mass., has participated in an experiment to study the effect of a 120,000 Joule spark discharge system, used for seismic profiling, on a known concentration of fish off the New England coast. After a concentration of cod was located at 18-20 fathoms on Nantucket Shoals, a flag buoy was placed, and the "sparker" discharged about 50 times in the vicinity.

Codfish, mussels, and sea lemons taken within a 2-hour period following the discharges were dissected and examined. All organs appeared normal. There was no sign

of dead or injured fish at the surface. A recheck of the area 2 days later showed that fish were still present, and there were no abnormalities apparent in specimens dissected.



Develop New Handling Techniques for Catfish

An improved method for pumping live catfish from a floating live box to a holding tank has been developed by the Ann Arbor (Mich.) Gear Research Program staff. About 500 pounds of catfish were pumped into a vacuum tank and held for 2 hours; there was no mortality. Also, a unique holding net was tried into which catfish entered readily from a haul seine net.



Fig. 1 - Combination vacuum tank-fish pump developed by BCF for pumping live catfish from haul seine.

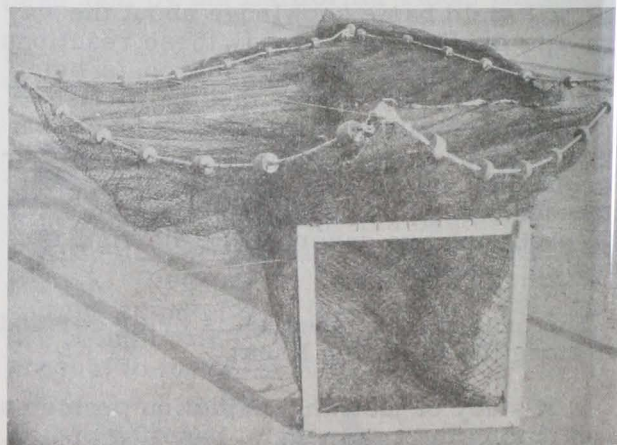


Fig. 2 - Detachable bag section used in conjunction with haul seine to hold catfish.

These techniques may be a breakthrough in the present difficult area of handling live fish from seine to shoreside containers in commercial operations. They may greatly reduce the mortality rate.

In the first trial, over 3,000 pounds of catfish were isolated and held without the fish showing signs of distress. The tests were conducted on a 40-acre pond near Yazoo City, Mississippi, and at Stuttgart Fish Farming Experimental Station in Arkansas.



Gloucester Lab Designs Eviscerator

BCF's Gloucester (Mass.) Technological Laboratory has applied for a patent on a device that automatically eviscerates fish, flush-washes the empty visceral area and packs the washed cavity with a refrigerant, such as ice. These operations are carried out "without cutting or otherwise damaging the fish."

The Gloucester scientists believe the eviscerator would be useful both to the commercial fishing industry and to fishing party boats.



Firms Request Continuous USDI Inspection

Three large fish-processing firms have applied for continuous inspection service by the U. S. Department of the Interior. The Sea Pak Corporation, Division of W. R. Grace and Company, requested inspection at its newly constructed plant on St. Simons Island, Georgia. Precooked and raw breaded fish sticks and portions will be the main products produced and inspected. The firm already has on the island a large facility that produces breaded shrimp.

The O'Donnell-Usen Fisheries Corp. requested the USDI service at its plant in Gloucester, Mass. The firm, which already has one plant under continuous inspection, produces primarily breaded fish sticks, portions, and frozen seafood dinners.

Booth Fisheries, a Division of Consolidated Foods, is completing construction of a processing plant in Portsmouth, New Hampshire. Many fishery products will be produced there. Booth also has a plant in St. Louis, Missouri, where much of the production of fish sticks and portions is USDI inspected.

USDI inspection at these 3 large plants will increase significantly the volume of inspected products available to the consumer.



Find Fewer Parasites in Pacific Hake

Scientists of BCF's Seattle Technological Laboratory report a significant reduction in the number of Pacific hake found infested with a near microscopic protozoan parasite. Before U. S. and Soviet fishermen began to harvest these fish on a large scale several years ago, 50 to 90 percent of the fish were found to contain the parasite, and 10 percent were heavily infested.

This year, as testing began for the third consecutive summer, a reduction in infestation was noted. Only 30 percent of the fish were infested, and only 3 percent heavily. Some suggest this reduction resulted from the removal from the fishing grounds and replacement by young fish of the older and mature fish. The latter had been in contact with the parasites for a longer time.

The parasite, a myxosporidian harmless to man, appears to cause no problem for the fish in its natural environment. But after the fish dies, the parasite releases an enzyme that softens the flesh and makes it less useful and desirable as food.



FEDERAL ACTIONS

Interior Department

\$4 MILLION MADE AVAILABLE FOR ANADROMOUS FISHERIES PROJECTS

More than \$4 million in Federal funds have become available to the states for anadromous fishery projects during fiscal 1968, Interior Department has announced.

Anadromous fish ascend rivers from the sea to spawn. They include salmon, striped bass, and shad. The Anadromous Fish Act, administered by BCF and the Bureau of Sport Fisheries and Wildlife, awards money for cooperative projects that will benefit these fish.

The money will be used to improve spawning areas, install fishways, construct fish protection devices and hatcheries, and to conduct research to improve management and increase stocks.

Under the 1965 law, Federal money may be used to finance up to 50 percent of approved state projects. Federal appropriations up to \$25 million are authorized through June 30, 1970.

* * *

TASK FORCE WILL INVESTIGATE OVERFERTILIZATION OF LAKES

Secretary of the Interior Stewart L. Udall and E. Scott Pattison, President of the Soap and Detergent Association, named a 13-man task force in August to recommend a cooperative research program for controlling eutrophication (overfertilization) of lakes.

Eutrophication is the excessive fertilization of algae and other aquatic plants with nutrients, principally nitrates and phosphates. Phosphate is a common element in municipal sewage, human waste, agricultural fertilizers, detergents, and industrial discharges.

As the public uses more nutrients, aquatic plants increase and die. Organic deposits pile up on the lake bottom. The lake becomes smaller, shallower, warmer, and organic decay depletes the supply of oxygen. It becomes a marsh and eventually disappears. Lake Erie is an example of serious eutrophication in the U. S. There, much of the oxy-

gen has disappeared and aquatic plants are filling the lake.

Industry Enlisted to Help

The help of many industries is being enlisted by the Department of the Interior in solving the problem. The industries include fertilizer, chemical, phosphate, agriculture, and others that discharge wastes containing phosphates and nitrates.

The task force will recommend a broad research program that may be initiated by Government and industry.

* * *

TASK FORCE OFFERS PLAN TO EASE ALEWIFE PROBLEM

A Federal task force named by Interior Secretary Stewart L. Udall to study the alewife problem in the Great Lakes has recommended a remedial plan.

In recent years, the vast annual death of alewives has clogged water systems and covered beaches. In spring and summer 1967, millions of dead alewives drifted onto Lake Michigan beaches--forcing out some homeowners, drastically reducing tourist trade, and producing an expensive cleanup condition.

The program proposed by the task force on September 21 seeks to ease the immediate problem and go on to make the lakes completely useful again. Lake Michigan would receive attention first. The group is headed by Dr. Stanley A. Cain, Assistant Secretary for Fish and Wildlife and Parks.

3-Stage Program

The plan proposed has 3 stages:

1. Measure the alewife population, predict the amount and place of the enormous annual deaths, and determine the causes.
2. Find methods to remove efficiently the vast carpet of dead fish from the lakes and shores.
3. Reduce the alewife population and restore a balance of native and new fish species.

Federal and State Cooperation Necessary

The task force believes that Federal and State cooperation will be necessary to achieve the goal. It recommends that the joint U. S.-Canadian Great Lakes Fishery Commission--which coordinates fishery development in the lakes--participate actively. Federal aid programs would increase state efforts.

In addition to Dr. Cain, task force members are: Frank C. Di Luzio, Assistant Secretary for Water Pollution Control; Commissioner James M. Quigley, Water Pollution Control Administration; Director H. E. Crowther, BCF; Director John S. Gottschalk, Bureau of Sport Fisheries and Wildlife; and Dr. Milner B. Schaefer, Science Advisor to Secretary Udall.

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PROPOSE IMPORT CURBS ON TROUT-LIKE FISH OR EGGS

A proposed amendment to the Code of Federal Regulations, Importation of Wildlife or Eggs Thereof, was published by Interior Department's Bureau of Sport Fisheries and Wildlife in the "Federal Register" on July 27. The amendment would prohibit import of wild birds or their eggs. It also includes salmonids of the fish family Salmonidae, which embraces all species of fresh and frozen trout and fresh and frozen Atlantic and Pacific salmon.

Certificate Required

The proposed amendment prohibits import into the U. S. of all live or dead fish, or eggs of salmonids of the family Salmonidae, unless these imports are accompanied by a certificate signed by selected officials in country of origin or in U. S., that the products are free of viral and bacterial diseases and parasitic infections.

Extend Time for Comments

A period of 60 days from July 27 was provided within which persons might file written comments, suggestions, and objections with the Director, Bureau of Sport Fisheries and Wildlife, Washington, D. C. 20240. This period has been extended to November 30.



Federal Trade Commission

PROPOSED GUIDES FOR DOG AND CAT FOOD INDUSTRY PUBLISHED

The Federal Trade Commission published a notice of Proposed Rule Making in the "Federal Register" September 16 to guide the Dog and Cat Food Industry.

The proposed guides include sections on: (1) Definitions; (2) Misuse of terms; (3) Grade or quality misrepresentation; (4) Misuse of terms "can" and "canned"; (5) Deceptive pricing.

The definitions include:

(u) "Fish" is the clean, acceptable, fresh flesh and incidental bone of any fish, freed of the head, scales, fins, and viscera. When canned, all bone should be cooked to a soft consistency.

(v) "Whole fish" is clean, acceptable, whole, fresh, fish (unscaled and unviscerated), under 19 inches in length. Larger fish should be freed of their heads, viscera, scales, and fins, and described as fish. When canned, all bone should be cooked to a soft consistency.

(w) "Fish meal" is finely ground, dry, rendered fish or whole fish.

(x) "Chowder" is acceptable, thick seafood soup or stew containing at least 30 percent of the type of seafood specified in advertisements and on labels.

