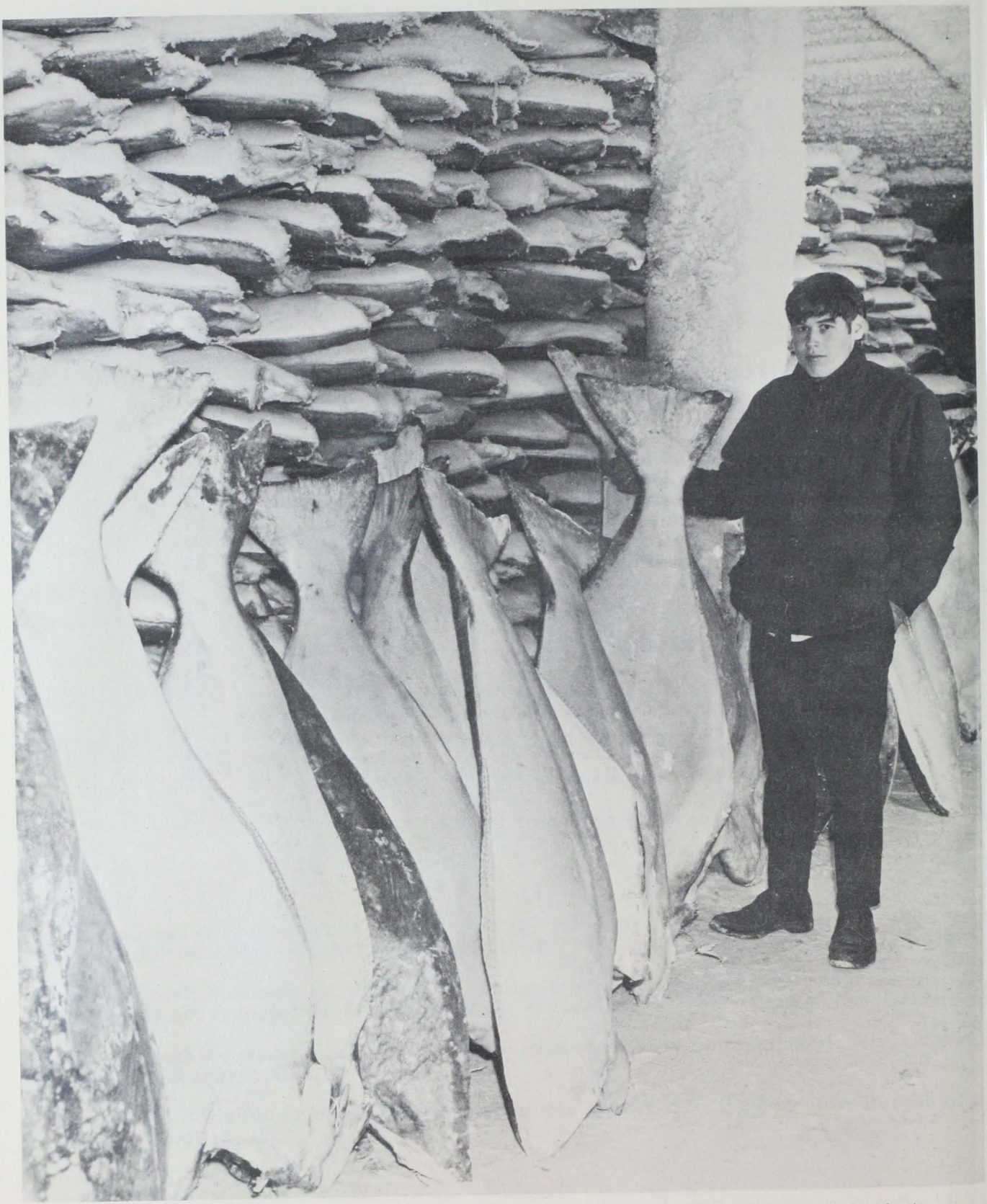


Halibut are stacked like cordwood in this Juneau, Alaska, cold-storage plant. (BCF-Alaska photo: J. M. Olson)

U.S. FISHERMEN EARNED RECORD $518 MILLION IN 1969

U.S. fishermen caught 4,292 million pounds of fish and shellfish in 1969. The catch sold for $518 million--the highest dollar value ever. The value was $47 million above 1968, and 31% above previous 10-year average. The catch was 176.4 million pounds, or about 4%, more than in 1968, and the largest catch since 1966. These data were reported by BCF's Division of Statistics and Market News.

There were record landings of Gulf menhaden, Pacific anchovies, yellowfin tuna, shrimp, spiny lobsters, tanner crabs, Dungeness crabs, and surf clam meats in 1969; and sharp increases in the catches of Atlantic cod, Pacific halibut, and blue crabs. Landings of Atlantic flounders, pollock, and soft clams were higher than in 1968.

Offsetting any real large gain in overall productivity of domestic fisheries were serious declines in landings of haddock, Atlantic sea herring, Pacific salmon, whiting, otter-trawl-caught industrial fish, sea scallop meats, and king crab. Production of jack mackerel, Atlantic ocean perch, and oyster meats also was below 1968 levels.

Record 12.08¢ A Lb.

Fishermen were paid a record average of 12.08 cents per pound for the larger 1969 catch; in 1968, the average was 11.46 cents; in 1967, 10.84 cents. The average price for many fishery items increased substantially in 1969, while other prices were somewhat higher, or at least held steady.

The smaller 1969 whiting catch (down 41%) actually gave fishermen as much money as the larger 1968 catch. Average prices paid for most other failing fisheries also increased to where total exvessel value paid was nearly equal to that received for the larger 1968 catches. Average prices paid to fishermen, measured by indexes of exvessel prices received, rose 13% from 1968 and 40% above 1957-59 average.

The index for all finfish prices rose 14% in 1969 because of sharp increases in prices for New England finfish, salmon, tuna, and industrial fish. Prices paid for all shellfish increased 14%. Prices for shrimp increased 9%, while other shellfish prices increased 17%.

PROCESSED FISHERY PRODUCTS

The 1969 value of processed fishery products produced in the U.S. from domestic and imported raw material was $1.5 billion--about 6% above 1968. The canned pack of 40.3

million standard cases was worth $580.8 million--slightly below 1968's record $583.9 million.

Canned tuna was produced at about 1968 level; packs of crab meat, shrimp, and clam products were larger.

Industrial products increased $14.5 million.

The remarkable fish stick and portion industry continued to set new volume and value records: Production was 329.8 million pounds valued at $134.7 million.

Breaded shrimp processors turned out 104.6 million pounds (just short of breaking 1966's record 104.9 million pounds). It was worth a record $110.5 million.

Domestic production of groundfish fillets and steaks continued to decline as expected, but output of other fillets and steaks increased. Total production of these items increased in volume and value in 1969.

Processors of fish and shellfish specialty dinners, and other packaged fish and shellfish products, continued production increases. Their products were worth over $438 million--8% above 1968.

Exports of U.S.-produced fishery products were worth a record $104.5 million--a gain of $36.8 million--while imports also reached a new high of $844.3 million

AT YEAR'S END

At the end of 1969, some segments of the industry were facing declines in resource availability due to natural causes and heavy fishing; other segments remained highly competitive with foreign fleets and production. With only few exceptions, prices for fishery products generally increased at all levels: exvessel, wholesale, and retail. Fishermen received a high dollar exvessel value in 1969. The processing industry generally made excellent production gains. Many canned items, fish sticks and portions, fillets and steaks, shellfish (lobsters, crab, shrimp) products, and other fish and shellfish products were in good demand throughout 1969; many of these items made new inroads into foreign markets.

Civilian per-capita consumption of edible fishery products increased from 11 pounds of edible meat in 1968 to 11.1 pounds in 1969--the highest since 1954.

U.S. REGAINS 5TH PLACE IN WORLD FISHING

U.S. commercial fishermen caught about 5.5 billion pounds (live weight) in 1969, an increase of about 1 million pounds over 1968. This catch regained for the U.S. fifth place among the world's fishing nations. The catch figure includes the shell weight of mollusks, as is done by foreign nations. Shell weight is excluded in U.S. data on catch value.

Preliminary statistics indicate that Norway, formerly No. 5, dropped to sixth, the U.S. position in 1968. Norway's 1969 catch of 4.9 billion pounds was down 800 million pounds from 1968.

Japan Regains No. 1

Japan has regained the number one position she had held for many years. Her 1969 catch of 20.3 billion pounds was 1.2 billion greater than the 1968 figure.

Peru Falls to No. 2

Peru, which had led the world for several years, dropped to second place. Her catch was estimated at 19.5 billion pounds, a decline of more than $2\frac{1}{2}$ billion pounds. Peru's fishery is primarily anchovies. These are converted into fishmeal, and most of it exported.

USSR No. 3

Preliminary data show the USSR No. 3 with 16.1 billion pounds, up 1.4 billion from 14.7 in 1968.

Mainland China is believed to rank fourth. However, reliable statistics have not been available since 1960.

BCF IN COOPERATIVE SURVEY FOR INDUSTRIAL FISH IN ATLANTIC

BCF is using advanced electronic equipment and fishing gear in a cooperative Government-industry survey of herring and herringlike fish underway along the Atlantic Coast. The 3-month study began March 15 and will extend from New Jersey to Florida.

The midwater schooling fish are not used much by U. S. fishermen. These fish might supplement the declining Atlantic Coast menhaden, the most important "industrial" fish, which is used primarily for fishmeal.

Fishmeal Demand 800,000 Tons

The annual U. S. demand for fishmeal fluctuates around 800,000 tons: 200,000 tons are supplied by U. S. fishery, the remainder by imports. Annual imports are worth about $108 million. Use of the many species of herringlike fish by U. S. processors could significantly strengthen the fishing industry.

4 Survey Vessels

Four vessels will be used in the survey: the new stern trawler 'Delaware II' from BCF's North Atlantic Region, the 'Oregon II' from BCF's Gulf and South Atlantic Region, North Carolina's 'Dan Moore', and a menhaden industry vessel.

Commercial Scale Fishing

The Oregon II, equipped with sophisticated acoustical devices, will locate fish schools. The Delaware II, with modern acoustical fish-detection gear, will conduct commercial-scale fishing with pelagic (mid-water) and bottom-trawl fishing gear.

Catches will be transferred from Delaware II to the industry vessel and taken to shore. There, their suitability for fishmeal and oil will be evaluated.

Preliminary reports of findings are scheduled to be distributed by June 30.

SKIPJACK & YELLOWFIN TUNA SCHOOLS FOUND NEAR AMERICAN SAMOA

Scientists of the BCF Biological Laboratory in Honolulu have located numerous schools of skipjack tuna in the waters surrounding American Samoa, reports Richard S. Shomura, Acting Area Director, BCF, Hawaii.

In addition to skipjack, some mixed schools of skipjack and yellowfin were found.

American Samoa lies below the Equator, about 2,500 miles south and a little west of Hawaii. The Laboratory's research vessel 'Charles H. Gilbert' completed the first systematic survey of the area's fishery resources and returned to Honolulu in mid-April.

American Samoa is the site of two canneries. These depend for their raw materials not on surface-swimming fish caught near the islands--but on deep-swimming tunas from a broad belt of the open sea reaching almost to the South American coast.

The Government of American Samoa seeks to broaden the islands' economic base by harvesting surface-swimming tunas and other fisheries in the surrounding area.

Gilbert's Findings

The Gilbert's findings substantiate previous fragmentary reports that there are many schools of surface-swimming tunas in the area during the Southern Hemisphere summer. Sightings of fish schools approached five a day, about the average attained during the height of the Hawaiian summer season. The fishery for the skipjack tuna, the largest in Hawaii, reaches its peak in July.

Most of the skipjack caught were 10 to 14 pounds, smaller than the "season" fish in Hawaii. Fish were taken for tagging so scientists may follow their migrations. More than 500 fish have been tagged to date. These include yellowfin tuna, bigeye tuna, and skipjack. Blood samples were also taken. The samples will be analyzed later at the Laboratory in an attempt to trace the relation of the tunas of Samoa with those of other Pacific Ocean areas.

The Gilbert sighted skipjack tuna schools as far as 200 miles south of the Samoa Islands. To the north and northwest, beyond the independent nation of Western Samoa, the limits were much closer to shore; most sightings were within 40 or 50 miles of land.

The Gilbert carried a supply of live bait--threadfin shad--from Hawaii. She also was able to locate local bait supplies in Pago Pago Harbor.

SQUID SLURP IS TESTED SUCCESSFULLY

The Squid Slurp, a new pumping system, promises to eliminate much of the hard work in the San Pedro, Calif., squid fishery, reports Dr. Alan R. Longhurst, BCF La Jolla Laboratory director. The system was developed by Matt May and Bob Payne, operators of the 68-foot commercial fishing vessel, ERM-TOO, and Susumu Kato, fishery biologist at La Jolla.

During one day's fishing in February, May and Payne landed 30 tons of squid (now selling for $27.50 a ton dockside) at Port Hueneme. This was not unusual for them because they have been fishing squid for many years. But these squid were caught with a pump--without any net or brail. It was a cooperative experiment in which BCF provided most of the gear, while May and Payne contributed their vessel and fishing experience.

Traditional Squid Fishing

The traditional way to fish squid, explained Dr. Longhurst, is to anchor the vessel and turn on attracting lights at dusk. Brailing begins when enough squid gather under the lights. Usually, one fisherman holds on to the handle and purse line of the brail, while second pulls the brail through the concentration of squid. A third man operates a winch, which lifts the brail out of the water, and dumps the squid into the ship's hold.

With the Squid Slurp, the lighting arrangement remains unchanged, but the basic fishing unit is a pump with an 8-inch-diameter inlet that sucks in water at the rate of 1,600 gallons per minute to the pump inlet. A flanged elbow and 10-foot section of steel tubing is attached to a funnel with an opening measuring 3 feet by $1\frac{1}{2}$ feet. Inside this funnel is placed a waterproofed light, and the entire unit is submerged. An 8-inch fish hose carries the squid to a dewatering screen on board, which leads to either of two fish holds by means of an adjustable chute.

On the night of February 25, squid rose abundantly under the lights. The pump on the ERM-TOO was started at 8 p.m. The squid were pumped slowly and steadily into the well but, during one 15-minute period when they swam directly toward the funnel, about 10 tons were taken aboard. After 4 to 5 hours of pumping, 61,350 pounds of squid were taken aboard.

Pump's Advantages

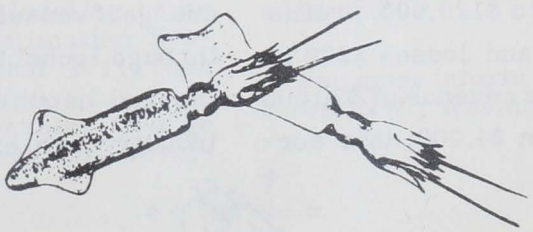
Dr. Longhurst noted that the pump will reduce the crew to two and eliminate brailing. When squid are running directly into the funnel, pumping is faster than brailing. Only one man is required to stay on deck to watch over the pumping operation and to chase away the birds, sharks, pilot whales, and sea lions that prey on the squid and cause them to dive. Meanwhile, the second man can sleep and be ready for the long run to the processing plant.

Chief Disadvantage

The chief disadvantage of the pump, at least with the present setup, is that operations are difficult in rough seas. Pumping is also slower than brailing when squid are "dead" under the lights, or when they swim away from the entrance to the funnel.

Encouraged by their early success, May and Payne later decided to enlarge the funnel entrance to 6 X 4 feet. With this modification, they have landed up to 160,600 pounds (80.3 tons) of squid with the pump in one night's fishing. This is a record for a two-man crew.

Dr. Longhurst concluded: "With further improvements in the equipment and perhaps in the lighting system, pumping may eventually outfish brailing under all condtions."



SAN PEDRO FLEET'S FINANCIAL CONDITION STUDIED

BCF's Pacific Southwest Region reports that, in 1968, researchers at the BCF Fishery-Oceanography Center, La Jolla, Calif., began to investigate the financial condition of the San Pedro "wetfish" boat fleet. The fleet is composed of small (40 to 86 feet) purse seiners that operate within 100 miles of port. Its boat owners and fishermen have been financially hard-pressed for years. They complain of static prices for fish and rising costs. Between 1958 and 1968, the fleet dwindled from 48 to 25 vessels. Its newest vessel was built in 1947; half of the fleet was built before World War II.

1967 Landings

In 1967, the fleet landed about 82 million pounds. It accounted for 77% of jack mackerel, 54% of Pacific mackerel, 58% of bonito, 12% of bluefin tuna, and 54% of anchovies landed in California. Mackerel, bonito, and tuna are canned; anchovies become fish meal and oil.

Poor Financial Shape

The researchers' first objective was to describe and document the fleet's financial condition. With vessel owners' permission, financial data were gathered from bookkeeping firms. Analysis showed the fleet in poor financial shape. During 1963-68, annual revenue ranged from $45,000 to $120,000, profits from $1,400 to $34,000, and losses $200 to $10,000. The average gross revenue of $70,000 produced a profit of about $4,000; this corresponded to break-even point. Crew earnings stayed constant and averaged $4,000; crew size decreased from 380 to 240; number of vessels from 48 to 25.

Costs-and-Earnings Model

The second objective was to construct a costs-and-earnings model for wetfish operations. This would permit examination of the economic feasibility of new-vessel construction for vessel replacement or fleet expansion. The model took account of operating costs, taxes, depreciation, and arbitrary levels of gross revenue corresponding to those in the fishery in recent years. Their profit return on investment and crew earnings were predicted for vessels of various sizes--newly constructed or existing--for various conditions of catch.

Other Fisheries' Surplus Vessels

The researchers concluded that, with proper market conditions, fleet expansion through recruitment of suitable surplus vessels from other fisheries would be economically feasible. The outlook for new-vessel construction was found unfavorable. Even with a 50% construction subsidy, a vessel would need $225,000 gross revenue, an amount well above present peak levels, to attain the 1967 profit level. However, the picture would change if vessel efficiency could be increased through technological improvements in fishing and handling procedures. BCF and the industry are examining these possibilities.

GATE DESIGNED TO RELEASE PORPOISE FROM PURSE SEINES

After talking to fishermen, gear technologists, and behaviorists, William Perrin of BCF LaJolla, Calif., developed a tentative design for a rescue gate for porpoise caught in purse seines. A triangular piece of webbing will be cut from the net to leave a gap about 4 fathoms long and 1 fathom deep at the center. Then, a large triangle of webbing will be sewn into the opening. The corkline for this section will consist of several inflatable sections, perhaps constructed of large diameter firehose. A system of independent air conduits will lead to a single connector at the end of the gate area. A skiff equipped with a gasoline-powered vacuum pump and compressed air tanks will connect to the air system after the net is set; the skiff will remain stationed at or near the gate during the rescue operation, which will be coordinated from the mast.

Opening and Raising Gate

The gate will be opened by evacuation of the corkline--and raised by rapid injection of air from the tanks. A prime requisite is that it be possible to raise the gate in a second or two when fish are seen heading toward it. It is hoped the extra webbing will reduce downward pull of the sunken corkline.

Modeling experiments using a miniature purse seine are being carried out. Construction of a prototype will begin immediately thereafter. If all goes well, the gate should be ready for testing under actual fishing conditions in late summer 1970.

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FISHERIES FEATURED AT MARINE TECHNOLOGY SOC. EXPO.

On Monday, June 29, 1970, the Marine Technology Society Conference and Technical Session will open at the Sheraton Park Hotel in Washington, D. C., and run through July 1. The Nation's suppliers of oceanographic equipment will meet "to discuss past, present, and future problems and hopes of the ocean environment."

One entire afternoon session will be devoted to Marine Biological Resources--fish, oysters, and lobsters. It will include three papers by BCF speakers: "Recent Developments in the Economic Theory of Commercial Fishery Management," E.W. Carlson and A.A. Sokoloski; "The Determinants of Actual and Subsidized Competitive Strengths and Weaknesses of the U.S. and Canadian Groundfish Fisheries," Donald P. Cleary and A.A. Sokoloski; "Economic Benefits to Fisherman, Vessels and Society from Limited Entry to the U.S. Northern Lobster Fishery," F.W. Bell. Also, "Computerized Modeling of an Acoustic Fish Abundance Estimation System," John B. Suomala Jr. and William Vachon, MIT; "Optimal Conditions for Oysters Grown in Closed Environments," George Claus and Cyrus Adler, Offshore/Sea Development Corp.

At another session, BCF's Edward F. Klima will talk about the development of an advanced-technology high-seas fishery and processing system.

Several other sessions among the 26 should interest CFR readers: buoys, undersea vehicles, marine geodesy, seagoing computers, cables and connectors, power systems for undersea habitats, oceanographic instrumentation, underwater optics, waste management and coastal zone, ocean mining, economic considerations in coastal zone management, critical legal issues, risks and opportunities in ocean industry, and corrosion of equipment at sea.

General Chairman of the MTS Conference is Donald L. McKernan, Special Ambassador for Fisheries and Wildlife to the Secretary of State, president-elect of MTS, and former head of BCF.

For more information, contact MTS, 1730 M Street NW., Washington, D.C. 20036

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INTERNATIONAL FISHERIES SURVEY CONTINUES OFF U.S. WEST COAST

The Soviet research vessel 'Ogon' left San Pedro, Calif., on March 13 to continue an international fisheries survey of the population of Pacific hake off Oregon and Washington. The vessel is operated by the Far Eastern Seas Fisheries Research Institute in Vladivostok.

Dr. Alan R. Longhurst, director of the BCF laboratory at La Jolla, reported that Ogon had just completed an egg-and-larva survey of spawning hake off California and Mexico with the assistance and advice of U.S. fishery biologists.

The Pacific hake spawns off California and Mexico each winter. The abundance of adult hake is estimated from the number of their eggs and larvae taken in plankton samples.

2nd Year of Cooperation

This is the second year of cooperative research on U.S. hake fisheries. The hake is a favorite food of Soviet citizens. It is fished heavily by the Soviet fleet in international waters off the Pacific Coast; in the U.S., hake is an important raw material in producing fish protein concentrate (FPC). The data from the cooperative surveys are necessary to provide a scientific basis for agreements to protect and conserve the species off North America.

San Francisco to Vancouver Island

Ogon is under the scientific leadership of Dr. Nikolai S. Fadeev of Vladivostok. The Soviet vessel rendezvoused on March 18 with a U.S. Coast Guard cutter to take aboard an observer, Eugene S. Maltzeff of BCF's Seattle laboratory. With him aboard, Ogon began using her acoustic echo-sounders to survey hake and rockfish stocks from San Francisco to Vancouver Island. The survey will end at the island by the end of May. The vessel will fish only to check the results of the acoustic survey.

Already, BCF scientists at La Jolla are working on samples and data from Ogon's plankton survey. They have found that hake, in response to warm ocean conditions, have spawned this year considerably farther north than last year.

As in previous years, the data from the acoustic surveys will be received from the Soviets at a scientific meeting in Moscow this fall.

Mary Kalin, BCF biological technician, sorts plankton samples for presence of hake eggs and larvae aboard Soviet research vessel Ogon--in presence of Dr. Nikolai S. Fadeev, vessel's chief scientist.

U.S. VISITORS WELCOMED ABOARD SOVIET FISHERY VESSEL

A 9-man U.S. team visited a Soviet factory ship on March 6, about 15 miles off Norfolk, Va., during the vessel's 6-hour stay. The team was permitted full freedom of the vessel.

A similar visit took place in April 1969. Both were made under a 1968 U.S.-USSR agreement on fisheries of the U.S. Middle Atlantic Coast. The two-year agreement, which extends and modifies one in effect since November 1967, provides that both nations will work together in developing information to conserve certain species: red hake, silver hake, scup, and fluke. These concentrate offshore in large schools during winter before moving inshore, where they are caught by U.S. fishermen.

The Soviet Union has agreed not to fish between Jan. 1 and March 30 in a 3,000-square-mile protected zone extending from Rhode Island to Virginia. This area is believed to be the prime spawning grounds of these species.

'Chopin' & the Fleet

The Soviet fleet fishing in the Atlantic from Rhode Island to Virginia is commanded by Viktor Zakharov, Western Fisheries Administration, with headquarters in Riga. His flagship is the 'Frederik Chopin,' a 5-year-old, 543-foot vessel built in Poland's Gdansk shipyards. The U.S. visitors described her as "clean and well kept with up-to-date fish processing equipment."

Zakharov commands a fleet of about 100 fishing vessels, including 5 or 6 additional factory ships and refrigerated transports. Most of the fleet comes from the Estonian, Latvian, and Lithuanian Republics.

What They're Fishing

The fleet is fishing only for mackerel, sea herring, and river herring. Most fish is salted in barrels or frozen in freezing trays. The Chopin is equipped to produce canned fishery products as well as fish meal and oil, but these lines were not in operation during the visit. The vessel has a capacity of 13,600 gross tons.

Because stocks of Norway and North Sea herring are dwindling, Zakharov said, the Soviets had become interested in herring fisheries off the U.S. coast, which are not fished by Americans. He said herring from mid-Atlantic is less desirable than Norway or North Sea herring because of a lower fat content, but larger catches compensate for this. The demand for herring is good in the Soviet Union.

No Menhaden

The U.S. team also reported the Soviet claim that they have caught no menhaden. The Soviets believe this species stays close to the U.S. shore, where the 12-mile limit prevents foreign fishing. The Soviet Commander explained that his vessel conducts no specialized fishery for scup or fluke. He doubted his fishermen would be interested in these species because the Soviet Western Fisheries Administration does not rate them commercially exploitable. He said the Soviets help enforce the mid-Atlantic agreement with the U.S. by refusing to pay for scup. This did not insure that in bottom trawling by large stern factory trawlers for other fish, there would be some incidental scup.

'DELAWARE II' FINDS OCEAN QUAHOGS OFF SOUTHERN NEW ENGLAND

Extensive, commercially usable, concentrations of ocean quahogs (Arctica islandica) were located by BCF's Delaware II in January and February off southern New England (Cruise 70-1). More surveys are planned.

During the cruise between Nantucket Shoals and Amagansett, Long Island, New York, 382 survey stations were fished. This includes the eastern section of ocean quahog survey area 7 and western section of ocean quahog survey area 8 (see chart). The dredge was fished routinely for 4 minutes during each tow; one tow was made at each station.

Fig. 1 - Ocean quahogs. Size varies from 3 to 4 inches in length, 2.5 to 3.5 inches in height, and 1 to 1.5 inches in width. The colors range from dark mahogany to mottled black and white.

In area 7, 139 tows were made in 10 to 35 fathoms. Catches varied from a few individual ocean quahogs and surf clams to 5.2 bushels of ocean quahogs.

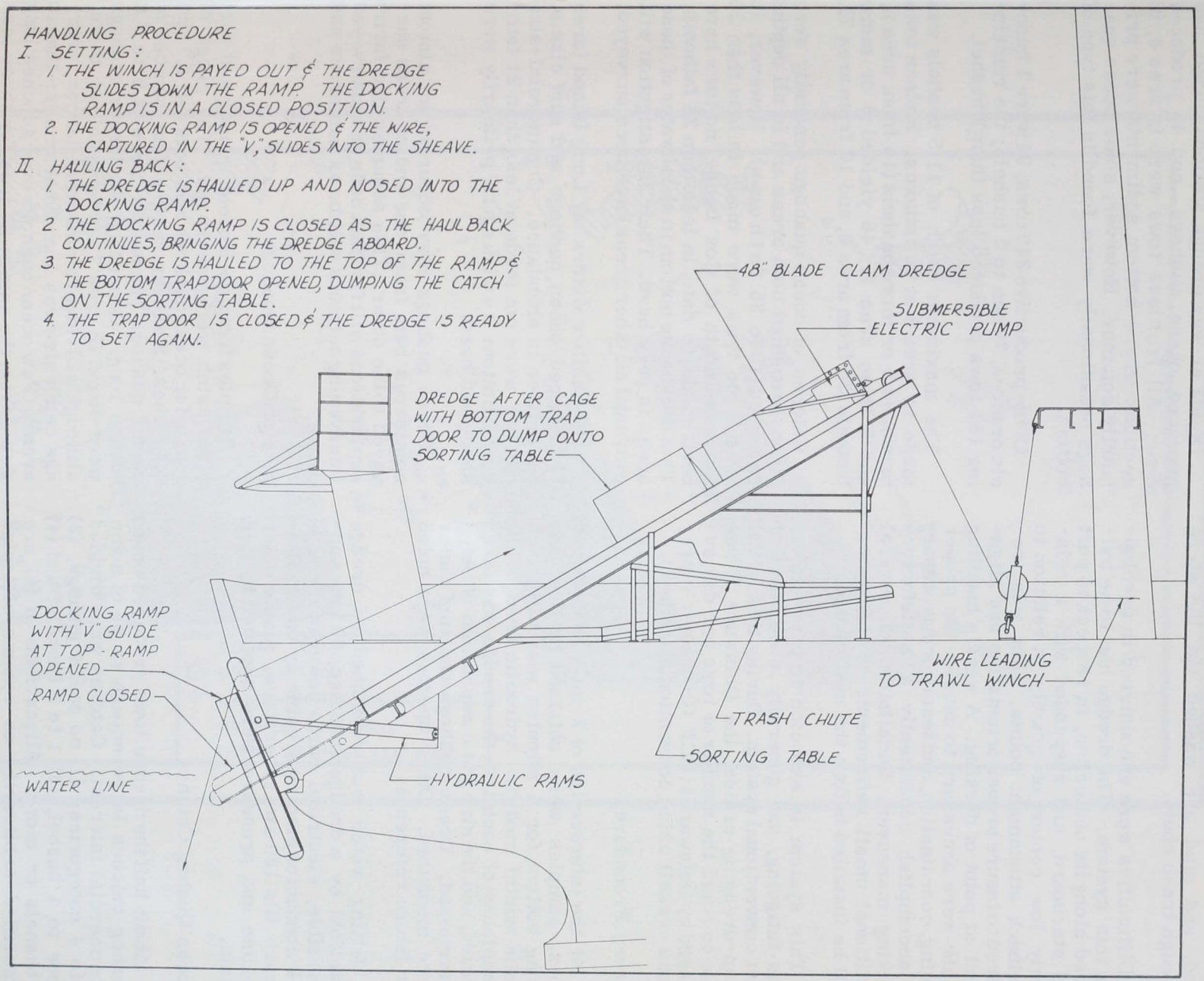
Of the 243 tows in area 8, in 20 to 35 fathoms, catches varied from 0 to 11.5 bushels of ocean quahogs. No live surf clams were found, although shells were taken.

Gear Development

The Delaware II has a high freeboard, so conventional dredge handling methods (hoisting dredge from vessel's side with a boom) were not practical. A new dredge handling system had to be designed.

A recent survey of the New Jersey clamming industry uncovered a method of setting and hauling the dredge from a vessel's stern. It was concluded that this method might be adapted to the stern trawler Delaware II. The current installation is a modified stern-haul system devised originally by Captain Eric Kirkeberg of Wildwood, New Jersey.

Figure 2 is a profile of the deck equipment. It identifies the major components. To set the dredge, the trawl warp is payed out--permitting dredge to slide down ramp and off vessel's stern. To haul dredge back, the docking ramp is first opened by hydraulic rams, and the wire is captured in the deep "V". Then hauling is started. Just as the dredge breaks the surface, the docking ramp begins closing as the haulback continues. The dredge is hauled to a point on ramp where bottom trap door can be opened to dump catch on sorting table. After dumping catch, the trap door is closed, and the dredge immediately set again. Sorting is done at tabletop level as trash,



, Fig. 2 - Stern chute clam dredge ramp used aboard Delaware II.

sand, and mud are washed out the stern through trash chute.

Difficulties were encountered in developing this system. The dredge had to be balanced along its centerline, in respect to port and starboard, and suspended with a relatively low center of gravity in relation to haulback attachment points. This was required to insure proper orientation and alignment at point of docking. A week's handling trials were necessary to develop the proper timing, coordination, and teamwork necessary to accomplish consistently a satisfactory docking maneuver. Installation of several additional small refinements to the system will be installed before the next cruise.

This system is expected to prove safer, less fatiguing, and generally more efficient than conventional system. During this initial clam-dredging cruise, the Delaware II was able to equal the number of tows per day averaged by Delaware I (BCF Gloucester's previous vessel) using conventional methods.

Survey Procedure

At the intersection of 2-mile spaced grid lines, samples were obtained by dredging along bottom for 4 minutes with a 48-inch (knife width) modified hydraulic dredge. At completion of each tow, the dredge was taken aboard, and the size and composition of catch determined. Ocean quahogs and surf clams were measured. Other species were noted for future reference.

Jetting water was furnished to dredge manifold by a dredge-mounted, 65 hp., submersible, electrical pump powered through a 4-conductor electrical cable by one of Delaware II's 150 kw. generators. Ample water volume and pressure were supplied by this pump.

Ocean Quahog Catches

About half the dredge tows produced ocean quahog catches large enough to be of some commercial interest. Catches were divided into 4 categories: (1) no ocean quahogs. (2) none to 1 bushel, (3) 1 to 2 bushels, and (4) 2 bushels or more. All catches in (4) are classified arbitrarily as commercial-size catches. However, many catches in 1 to 2-bushel category were just under 2 bushels; these would also be commercially valuable.

Of 382 survey dredge stations fished, 340 produced ocean quahogs, and 42 produced none. All fruitless tows were in area 8, in sections where bottom sediments were primarily soft mud. However, some ocean quahogs occasionally were found in this type of bottom.

Of the productive 340 tows, 94 were 2 bushels or more, 79 one to 2 bushels; the remaining 167 tows produced less than 1 bushel.

The maximum catch of 11.5 bushels was made in area 8 at 30 fathoms. Sixteen tows produced 5 or more bushels (14 from area 8, and 2 from area 7); 48 yielded 3 or more bushels (38 from area 8, and 10 from area 7).

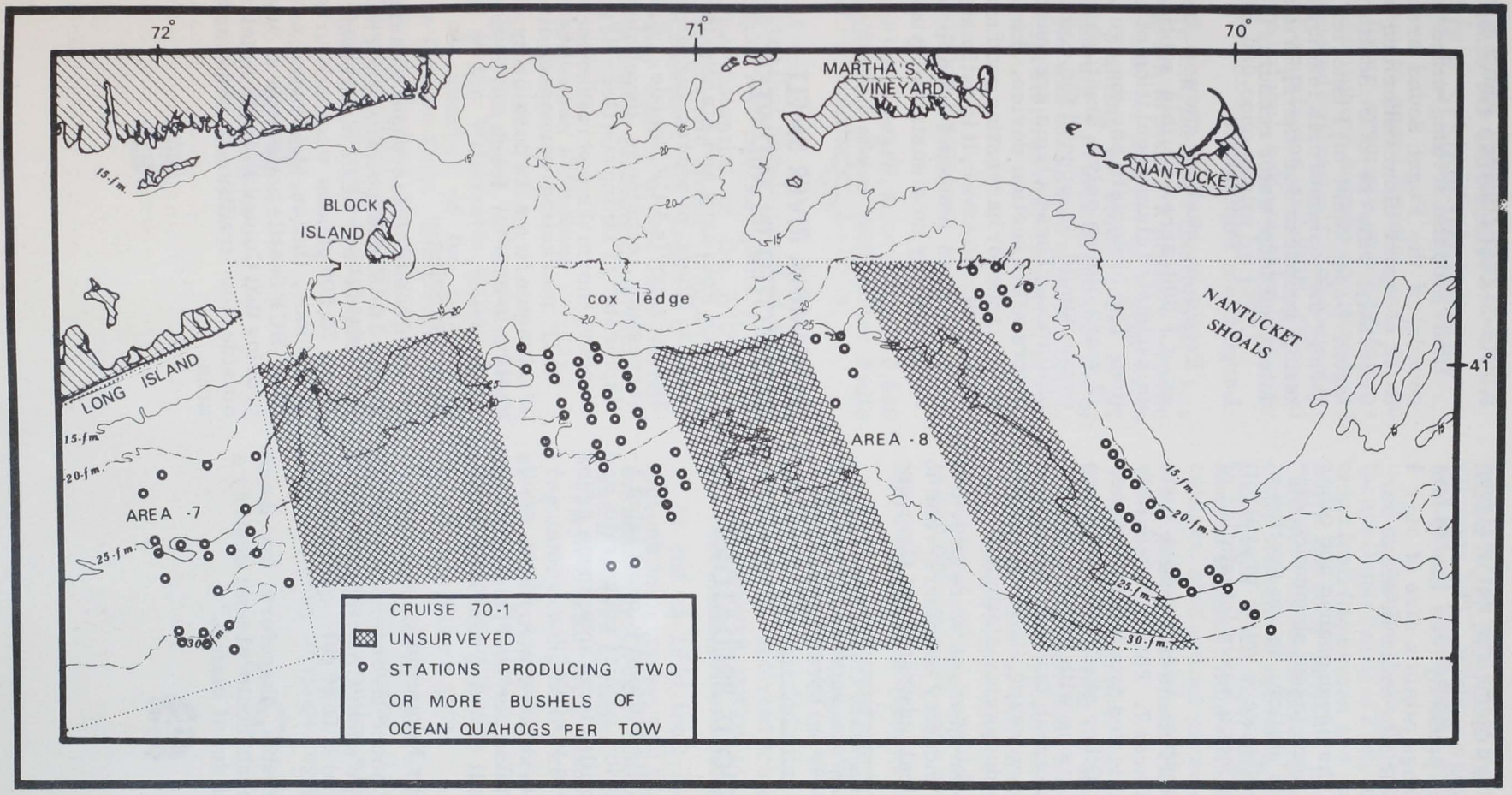
Catches of ocean quahogs generally were taken throughout both areas and in all depths surveyed (10 to 35 fathoms). However, in area 8, no tows were made in less than 20 fathoms; south of Cox Ledge, no tows have been made to date in less than 24 fathoms. This is because bottom in shoal water of these areas is very hard. Their investigation will wait until all other areas have been surveyed.

The shallow waters off Long Island (area 7) produced ocean quahogs and surf clams, but neither in abundance. Commercial-size catches were not made at less than 21 fathoms. Bottom sediments primarily were sandy and hard.

Ocean quahogs may occur in an almost continuous belt from one end of areas surveyed to the other. This assumes that future explorations will find that beds in unsurveyed intervening sections will be as numerous and dense.

Size of Ocean Quahogs

Samples from each ocean quahog and surf clam catch were measured. The range of length for ocean quahogs was between 1.3 and 4.4 inches. However, the greatest number of ocean quahogs measured were 2.8 to 3.8 inches long. Generally, the larger quahogs were found in area 7 off Long Island; there, although individual clams were larger, average catch size was somewhat smaller than in area 8. Few ocean quahogs over 4 inches long were taken; the same was true for those less than 2 inches long. The smallest size clams found probably do not reflect significantly either the occurrence or abundance of small


72°
71°
70°
41°
MARTHA'S VINEYARD
NANTUCKET
BLOCK ISLAND
cox ledge
NANTUCKET SHOALS
LONG ISLAND
AREA -7
AREA -8
15-fm.
20-fm.
25-fm.
30-fm.
CRUISE 70-1
UNSURVEYED
STATIONS PRODUCING TWO OR MORE BUSHELS OF OCEAN QUAHOGS PER TOW

clams because the dredge was not designed to retain the smaller quahogs. The scarcity of larger quahogs probably was due to fact that very few quahogs attain a size of over 4 inches during their life cycle in areas surveyed.

Many shells of the ocean quahog and other shellfish species were taken; abundance varied from station to station. In one section of area 8, bored shells were quite prevalent; these probably reflect a heavy infestation of predators.

The very few surf clams taken came from inshore depths of area 7. This is compatible with previously collected data from shallower waters of area 8. Other shellfish were taken from time to time, along with various finfish. It is of special interest that several specimens of the common razor clam were taken from some of the deepwater stations.

Samples of ocean quahogs were provided to interested industry members--and to BCF's Technological Laboratory at Gloucester, Mass.

For more information, contact Keith A. Smith, Base Director, or Phillip S. Parker, Fishery Biologist, EF&GR Base, State Fish Pier, Gloucester, Mass. 01930. Telephone: 617-283-6554.

CRABS ARE SERIOUS PREDATORS OF CLAMS

Studies by BCF's Milford (Conn.) laboratory of the predation rate of rock crabs and mud crabs on juvenile clams show these crabs to be serious clam predators.

A single rock crab can destroy as many as 25 10 mm-long clams per hour; a single mud crab up to 14 small clams (5 mm long) within one hour.

Rock & Mud Crabs Numerous

Rock crabs (Cancer irroratus) may be as numerous as 4 per square meter; mud crabs (Neopanope texana) up to 20 per square meter on shellfish beds.

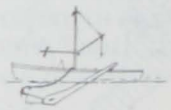
"It seems probable, therefore, that these two species of crab could almost destroy a good commercial set of clams."

KING-SIZED CLAMS MAY BE MARKETED

The geoduck, a king-sized clam (2 to 3 pounds) of the Puget Sound area, is a prize catch of sport clam fishermen on low tides. Currently, reports BCF Seattle, the Washington Department of Fisheries is investigating the commercial feasibility of marketing geoducks for the first time from an untouched deep-water resource (30 to 40 feet).

Large Clam Population

Previous studies showed the State has about 9,000 acres of this subtidal land with an estimated clam population of over 40 million. The biologists say the average clam is 12 years old, so only a small part of this reserve should be opened for commercial exploitation. These clams are taken by SCUBA divers with a suction device. Small trials are being made for harvesting geoducks on a 500-acre area. However, it is estimated that several hundred thousand pounds can be harvested yearly on a sustained-yield basis.



COLUMBIA RIVER SMELT PROMOTED IN MIDWEST

Each February and March, the lower Columbia River produces large quantities of smelt, reports BCF Seattle. With improved harvesting techniques developed by BCF's Exploratory Fishing and Gear Research Base, an above-normal surplus is expected this year.

BCF marketing personnel discussed with Washington firms the possibility of expanding their markets for fresh and frozen Columbia River smelt.

Midwest Sales

Samples of dressed and round smelt were shipped to Minneapolis for distribution to retail chains by BCF marketing personnel. Some 72,500 pounds were sold to retail chains in Houston, Dallas, Milwaukee, and Minneapolis. BCF Seattle hopes this is just a start in proving that Columbia River smelt can be sold outside the traditional Washington-Oregon area.

10-YEAR PLAN TO DEVELOP WILLAMETTE R. SYSTEM UNDERWAY

A program to speed development of the Willamette River system's potential for increased production of salmon and steelhead is being promoted by Oregon's Fish Commission, Game Commission, and BCF. One goal is to develop a natural, self-sustaining spawning run of 55,000 coho adults by 1978.

To achieve this, the Fish Commission has begun a program to plant 1.2 million juvenile coho salmon into the system each year for 9 years. The planting of small coho in 27 streams supplying 9 principal tributaries of the Willamette was completed around April 1. These fish will return as mature adults in fall 1971.

"Wild" Population Expected

During the last 5 years, an average of 6,600 coho adults passed above Willamette Falls each year.

It is expected that development of a "wild" population that will use completely, for the first time, the potential of the Willamette watershed will result from: completion of the new Willamette Falls fishway in 1971, improved water quality in Portland Harbor, and the heavy yearly planting program.

Enhance Anadromous Fish Runs

The development area embraces most of the breadth of the Willamette Valley, from the uppermost reaches of the tributaries northward to Oregon City. The Oregon Fish Commission believes development of the Willamette and its tributaries will be a major step in increasing Oregon's anadromous fish runs.

SOLUTION SOUGHT TO SALMON "SHAKER" PROBLEM

The Oregon Fish Commission, the California Department of Fish and Game, and west coast troll fishermen are working together to solve the coho "shaker" problem. The name "shaker" has been given to small coho salmon often shaken off the hook. The agencies and fishermen are concerting their efforts this season to gather information on the losses of sublegal size and out-of-season coho in northern California and southern Oregon ocean-troll fisheries.

The large number of these illegal coho killed while trolling for legal salmon during May and June concerns fishery agencies and fishermen. Biologists estimate the "shaker" mortality rate in this area is about 50 percent. Based on the estimated incidental catch of sublegal coho, it could mean a loss of up to 250,000 or more coho a year.

More Information Needed

The need for more information is apparent. Jim Bolin, manager of West Coast Trollers Association, offered the trollers' services in collecting the needed information during the 1970 season. Selected trollers will keep detailed logbooks, noting number, size, area, and time salmon were caught.

At end of 1970 troll-salmon season, the logbook information will be summarized and evaluated by Oregon, California, and Washington fishery agencies. The results will be reviewed with troll fishermen before any regulatory changes are recommended. Solutions could consider changes in seasons, minimum size limits, types of gear used, or a combination of these.

No Action Before 1971

No regulatory action will become effective before the 1971 season. If this is found necessary, legislative action would be required in California. The Oregon Fish Commission has authority to adopt regulations.

NEW MESH RESTRICTION FOR STEELHEAD IS EFFECTIVE

The $7\frac{1}{4}$-inch stretch-mesh size restriction placed on gill nets during the Columbia River commercial winter season by Oregon and Washington fishery agencies has effectively reduced the incidental catch of steelhead. So said Edw. G. Huffschmidt, chairman of Oregon Fish Commission, on March 16. This statement is supported by reduced steelhead landings--and results of a special experiment conducted during the 14-day winter season that ended March 5. The steelhead run appears smaller than average, but the study showed the fish were present and could be caught in good numbers with a "steelhead net" of 6-inch mesh.

2 Nets Compared

The study compared the effectiveness of the mesh restriction. It used two identical diver nets--except that one was a legal $7\frac{1}{4}$-inch taut mesh, while the other was the 6-inch taut mesh. Diver nets are gill nets with trammels, which are drifted near the bottom during the winter season. Under Oregon Fish Commission supervision, the two nets were fished alternately over the same drift by equally experienced and proficient commercial fishermen. The test fisherman using the 6-inch mesh caught 36 steelhead in 8 drifts over a 40-hour test period; the fisherman using the legal gill net managed only 6 steelhead. Both nets caught 8 chinook, indicating the larger $7\frac{1}{4}$-inch mesh net was as effective as the smaller net for chinook.

At the same time, the smaller steelhead are escaping the more restrictive gear: just 1 of 36 steelhead caught in the 6-inch mesh net exceeded 30 inches. In the more restrictive $7\frac{1}{4}$-inch net, 2 of 6 steelhead caught exceeded 30 inches. In the recent season, 61% of the steelhead exceeded 30 inches.

Mesh Restriction Effective

Figures on the recent winter season gillnet landings also bear out the effectiveness of the mesh restriction. Only 3,600 steelhead were taken, while 13,300 chinook were landed. Over the last 10 years, the average winter-season catch during seasons, varying from 14 to 19 days, has been about 5,600 chinook and 8,000 steelhead.

REPORTS ON SHRIMP SEPARATOR TRAWL IN OREGON ARE GOOD

The Oregon shrimp fishery has reported encouraging results from use of shrimp-separator trawls. Commercial vessels using separator trawls continue to make almost pure catches of shrimp; those using standard shrimp trawls are plagued with a high concentration of smelt and other contaminants.

4 Such Trawls Ordered

As a result of the early success of vessels using sorter trawls, fishermen converted another standard net to a sorter trawl recently, and ordered 4 new sorter trawls from netting companies.

ADVANCES IN CATFISH HARVESTING

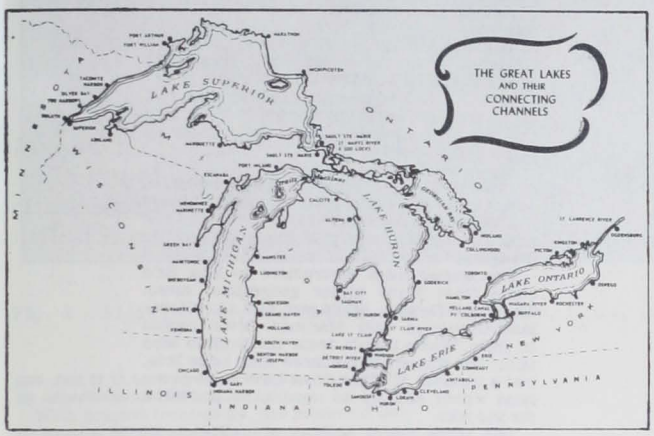
The BCF Kelso, Ark., Exploratory Fishing Station is testing a new version of a haul seine brailing bag. This has an automatic triggering device that allows the boom operator to empty it without assistance. If successful, this new device will eliminate time loss and manpower during loading.

Slightly modified live cars also are being constructed. These have openings at each end for testing feasibility of using two or more live cars in tandem--while attached to the seine during hauling.

An experimental catfish grader has been completed and will be field tested. The reaction of catfish to wire mesh boxes with various openings is being observed in a test flume. Also, the reaction of catfish in ponds to changes in climatic conditions is being studied.

HEAVY ALEWIFE DIE-OFFS POSSIBLE IN LAKE MICHIGAN THIS YEAR

Severe winter weather and the predominance of alewives at critical age levels could result in heavy die-offs in parts of Lake Michigan this year, said Assistant Secretary of the Interior Leslie L. Glasgow.



Because the alewife population is much below the 1967 level, when millions of dead fish washed ashore, especially near Chicago, a die-off of that magnitude is unlikely. The Illinois and Indiana shores are the areas most likely to be affected by localized 1970 die-offs.

Water Temperatures Important

The 1969 annual alewife survey by BCF's biological laboratory at Ann Arbor, Mich., showed a 60% increase over the 1968 population. A severe die-off would not be expected this year under normal conditions; however, the Lake Michigan area had below-normal winter temperatures. Research shows that alewives cannot tolerate excessively cold water, although they may not die immediately. If water temperatures warm rapidly this spring, the added stress of adjusting to it could trigger severe alewife mortalities.

A Small, Short-Lived Fish

The Great Lakes alewife is small. Adults average about $6\frac{1}{2}$ inches and weigh about 2 ounces. It is used principally for fishmeal and pet food locally. Although alewives are live food for larger fish, including Coho and Chinook salmon and lake trout, they compete with other fish for space and food.

Lake Michigan alewife stocks are now largely older fish; over half the adults are in their fourth and fifth years. Alewives are short-lived in the Great Lakes. Only about 30% of Great Lakes alewives can be expected to survive their fifth year.

It is believed that alewives migrated from their native habitat along the Atlantic coast into the Great Lakes via the St. Lawrence River and canals. They are in all 5 Great Lakes; they are the most abundant fish in Lakes Ontario, Huron, and Michigan.

Advance information on die-offs is important to vacationers and operators of resort areas, beaches, hotels, restaurants, and other businesses.

The annual survey will continue when the Ann Arbor laboratory's role is changed to give greater emphasis to recreational fishing and environment quality.

On The Death of Lakes

On March 3, 1970, Carl L. Klein, Assistant Secretary of the Interior for Water Quality and Research, addressed a meeting in Washington, D. C., on lake restoration.

This is what he said:

Lake pollution is perhaps the most crucial and most difficult of water pollution problems. This should come as no great surprise to anyone. Lakes generally do not benefit from the same cleansing action as a strong river current which might help flush away contaminants or dissolve them in a powerful flow of clean water.

Even without the contribution of man-made pollutants, lakes tend to develop eutrophication problems because of the nutrients that accumulate in them. But man can and must do much more to prevent the process from speeding up and causing the premature aging—and dying—of our freshwater lakes.

Like the living thing that it is, a lake is born, grows—even breathes—and slowly dies. The life cycle may last many thousands of years—or it could be a lot less. Much depends on the habitation that surrounds it. Man and his technology have become perhaps the gravest threat of all to the survival of lakes and of the other natural waterways which provide us with so many needs and enjoyment.

Death comes as a result of a lake slowly filling with silt and sediment. This is a natural process which manifests itself in reeds and water plant beginning to accumulate in shallow waters. The natural flow of streams through a lake may drain out the water, turning it into a swamp. The swamp plants then may give way to sturdier plants of a drier soil, and eventually, the one-time lake becomes dry land. In this manner, the United States has lost about half the lakes which existed on this continent some 12,000 years ago.

Where human habitation around a lake is relatively sparse, its waters can endure the minor damage contained in the wastes and debris thrown into it. The waters can assimilate a certain amount of wastes by decomposing them into harmless chemicals and dispersing them. But there is a limit to what a lake can absorb.

As ever-greater numbers of people and industry congregate around a lake and pour increasing amounts of waste into the water, the lake may become saturated and unable to purify itself. Man often does not realize the damage he has done until the lake begins to smell and the physical characteristics of pollution become obvious. By then, the pollution problem is already well past the stage of an easy solution.

Lake Erie is one of the most flagrant and frequently cited examples of lake pollution and eutrophication in this country. A look at its history and development is needed to help us understand the problem—and to prevent its recurrence elsewhere.

Lake Erie is the oldest, the Southernmost and the warmest of the five Great Lakes. It is only 241 miles long and has the smallest volume of water, with almost a 10,000-square mile surface area. The lake is very shallow, with an average water depth of only some 58 feet, and at its deepest point is only about 210 feet.

But Lake Erie also happens to be in the heart of one of America's greatest residential and industrial areas. It provides a resource to 11½ million people in the United States and Canada in terms of water supply, recreation, commercial fishing and shipping. And the annual value added by manufacturing in the Erie Basin stands at more than $17 billion.

By the year 2000—and, remember, that's only 30 years from now—the population of the Lake Erie area is expected to double, and so is the volume of industry in the Basin. These people and industries will depend on Lake Erie—a lake whose water quality must be maintained and enhanced so it can be passed on in a condition of unlimited usefulness.

As it now stands, Lake Erie is close to being strangled by the pollutants which pour daily into its waters. Municipal wastewater is the principal cause of pollution in the lake and its tributaries, with industrial wastes also occupying a major role, particularly in tributaries and harbors.

Among the most harmful discharges are untreated flows, combined sewer overflows and treatment plant effluents. Agricultural runoffs also leave their marks, as do wastes from commercial and pleasure craft, harbor dredging, urban runoff and soil erosion.

The wastes most destructive to lake Erie come from three major geographic areas. These are Detroit, Michigan, and the Cleveland-Cuyahoga and Maumee River basins in Ohio. Waste inputs from the Buffalo area affect the Niagara River more than Lake Erie, but a number of other areas have local problems which add up to significant pollution for the lake.

The three major sources of pollution in Lake Erie together discharge about 74 per cent of the phosphorous flowing into the lake, 87 per cent of the biological oxygen demand and 66 per cent of the chlorides.

The total BOD discharged to municipal sewage treatment plants in the Lake Erie Basin is equivalent to the raw sewage produced by 9.4 million people. After treatment, this volume is reduced to a load on the receiving waters equal to the raw sewage of 4.7 million people. In effect, this means basin-wide sewage treatment has an efficiency of about 50 percent.

Only about half of the 360 known sources of industrial wastes in Lake Erie and its tributaries can be classified as providing adequate treatment for their wastes. Yet together these industries account for 87 per cent of the total waste flow discharged into the lake or its tributaries.

The total industrial flow amounts to 9.6 billion gallons daily, with electric power production account for 72 percent and steel production 19 percent of the total. The steel, chemical, oil and paper industries discharge about 86 percent of the total industrial wastewater in the basin, excluding the electric power installations.

There are so many sources of pollution to Lake Erie that it is almost impossible to make an accurate record of all of them. However, the combined sewer systems of the cities of Detroit, Cleveland and Toledo are among the worst offenders, and just their overflows alone annually contribute wastes equivalent to the BOD of raw sewage from approximately 600,000 people. These combined sewer overflows are expected to represent a high percentage of future phosphorous contributions to the lake.

As you know, phosphorous is a major contributor to the process of eutrophication because of its stimulation to the growth of algae.

It only takes a small amount of phosphorous to create the conditions which precipitate algal growth. As little as 0.01 milligrams per liter at the beginning of the growing season in some lakes or an annual inflow of 0.2 to 0.5 grams per square meter of lake surface in others is all that is necessary.

And unlike nitrogen—which also contributes to this problem—phosphorous does not enter into the type of biochemical reactions that permit it to escape from water as a

Fig. 1 - Algae on shore and in lake, near Washington, D.C., indicate water is aging.

gas, nor is it easily removed from the system by organisms or sediments.

With present technology, the preferred way to control eutrophication is to impede plant production by making phosphorous less available for growth. And one important step in this direction is to reduce the amount of phosphorous-bearing effluents.

A certain amount of phosphorous is contained in the Earth's crust and enters surface waters from many natural sources. These include surface water runoff, soil erosion, waste from, and decay of, plants and animals, and dissolved and suspended materials in rain and snow.

Thus, over the course of hundreds and thousands of years, these small, but continuing inputs of phosphorous can by themselves bring lakes to an end through eutrophication and sedimentation—without man entering into it. The Green River oil shales of Colorado, Wyoming and Utah are a good example of lake deposits formed by natural euthrophication and sedimentation over a long period of time.

But man also produces significant amounts of phosphorous, and because of the tremendous population rise in recent years, and even greater increases predicted for the immediate future, his contribution to the eutrophication process is becoming a major challenge.

Municipal sewage contains considerable concentrations of phosphorous. It comes principally from phosphorous-bearing detergents and from human wastes. On the average, adult humans contribute about 1.4 pounds of phosphorous a year, while the use of detergents adds another 1½ to 2 pounds of phosphorous per capita annually, While some of the phosphorous is removed by conventional waste treatment processes, substantial amounts are discharged with no treatment at all.

The phosphorous used in detergents currently makes up some 50 to 60 percent of the total amount of phosphorous in municipal sewage. Obviously, this constitutes a major source of nutrient pollution which must be abated.

Our primary thrust on controlling this problem has been the development and demonstration of phosphorous removal technology for application at municipal waste treatment plants. This approach has been given priority because it attacks all of the sources of phosphorous in municipal wastes, regardless of its origin. We want to emphasize the fact that we are not out to throttle the detergent industry. Phosphate removal technology would have to be applied to municipal waste waters even if phosphates in detergents were to be completely eliminated from use.

The only roadblock that stands in the way of requiring the reduction or elimination of phosphorous from detergents at this time is that a substitute material has not yet been adequately tested which performs the same function as phosphorous. Until it can be proven that such a product will not cause some problem equally harmful to the environment, a substitute probably will not be placed on the market.

The Interior Department effort to clean up our lakes and other waterways is a continuing one, which we hope to expand, in order to demonstrate the restoration possibilities for all our water resources.

In Lake Erie, the existing backlog of unmet restoration needs includes the upgrading of sewage treatment by no fewer than 287 municipalities. The Lake Erie Basin should actually be served now by treatment sufficient to provide a minimum of 85 percent BOD removal, the almost complete removal of suspended solids and 92 percent removal of total phosphorus. It is to be anticipated that by 1990 the removal of over 95 percent of organic pollutants will be required throughout the Basin.

At present, there are some 189 industries which still have not installed treatment facilities sufficient to meet water quality standards. This situation is hardly excusable, and it shows we still have a long way to go just to conform to the pollution control regulations that are already on the books.

Our primary consideration must be to stop putting nutrients into our lakes. We must slow down the eutrophication process or we may discover our water resources becoming unusuable. We must also devise ways and means to reverse the entire eutrophication process to assure future generations of lasting sources of water.

In the Interior Department, our strategy is twofold: it consists of prevention and restoration. By prevention, we mean slowing

Fig. 2 - Scum and plant growth on Island Grove Pond, Abington, Mass. Overgrowth of algae spells death to other life, especially fish, in slow-moving water.

down eutrophication by removing key nutrients from wastewater before it enters a lake. At the same time, research and development must be carried on to find even more effective methods of nutrient removal.

Restoration means removing or inactivating nutrients after they have reached a lake. Restoration techniques must be carefully researched to find an economically acceptable method that is likely to succeed.

The mechanical harvesting of algae, the harvesting of organisms which eat algae and eliminating the effects of algae by chemical means are among the techniques being studied intensively by the National Eutrophication Research Program of Interior's Federal Water Pollution Control Administration. This work is being done in government and university laboratories, as well by private industry, and often uses small lakes in various parts of the country as field laboratories.

It is altogether doubtful whether Lake Erie could ever be returned to the condition which existed prior to man's appearance, or even to the condition which existed at the turn of the century. It can, however, be returned to some intermediate stage of aging, and we can expect a major improvement and protection of water quality.

Lake Erie and others threatened by eutrophication can be saved, but it can be done only with the continued and determined support of the public and its political representatives.

President Nixon set the tone for our efforts to control pollution in his State of the Union Message last January and in programs he launched in February to carry them through.

The President said, "The great question of the seventies is, shall we surrender to our surroundings, or shall we make our peace with nature and begin to make reparations for the damage we have done to our air, our land and our water?"

While, "The price tag on pollution control is high . . ." the price will be even higher if we fail to act. That is why we at the Interior Department are determined to act now while there is still time.

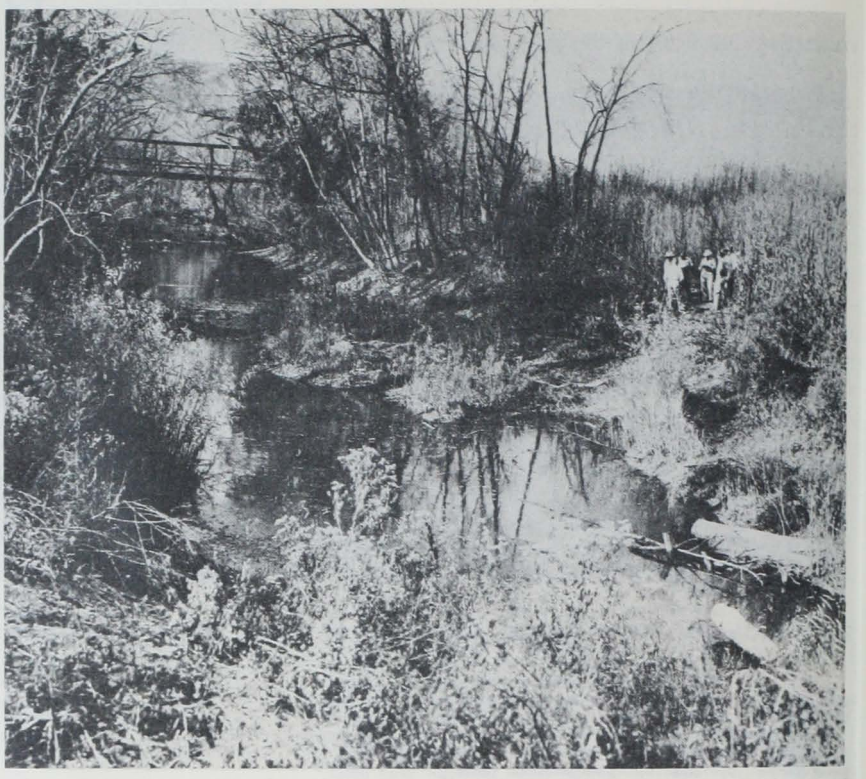


Fig. 3 - An Arkansas creek.

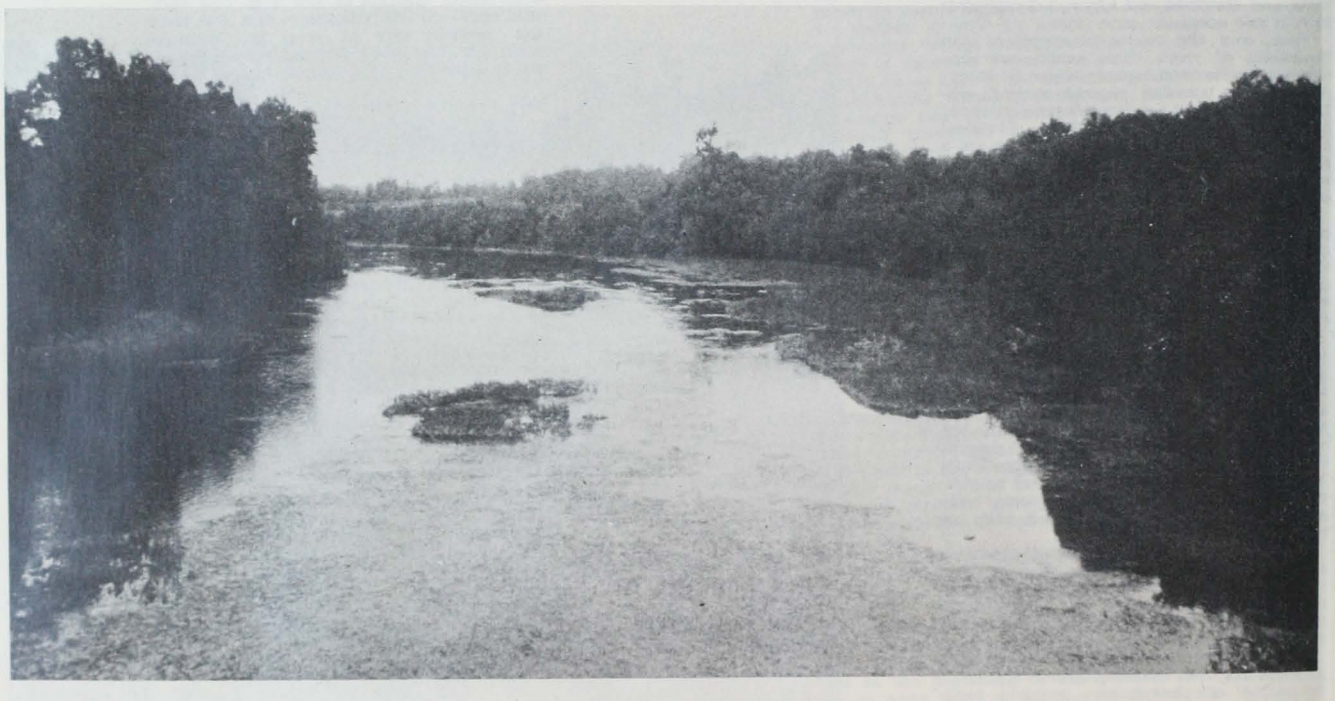


Fig. 4 - A surface blanket of filamentous green algae covers a large area of this river near Washington, D.C. These algae could be Spirogyra, Zygnema, Oedogonium, or Cladophora. (Photos: FWPCA)

'COMMERCIAL FISHERIES ABSTRACTS'

Commercial Fisheries Abstracts, a monthly journal, contains summaries of selected articles from about 350 trade, engineering, and scientific journals dealing with the entire spectrum of our fishery industries. These journals cover the biological, physical, and social sciences and the engineering, technological, and legal aspects of the aquatic resource supply, harvesting, processing, use, and distribution. The abstracter classifies each abstract into one of 10 main fields and further into basic subject groups in accordance with a classification system designed by BCF. Whenever possible, the abstracter includes sufficient information in each abstract to enable the reader to understand and use the results of the research described in the original article. In addition, he gives pertinent bibliographic information so that the reader can obtain the original article from a library or the author.

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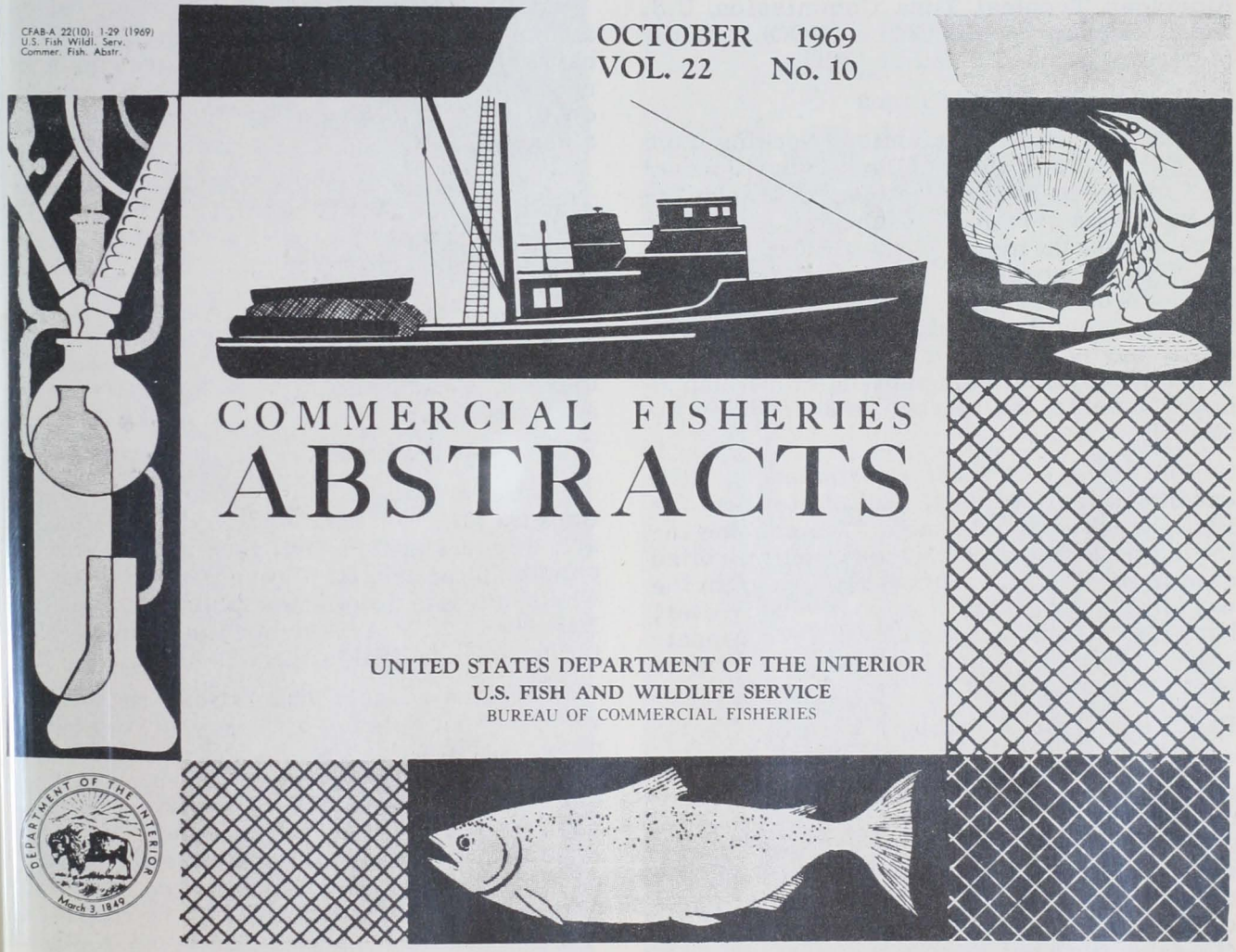
Frank T. Piskur, Editor



Study Origin of Oceans

NOO officials said this probe was designed "to test theories that are relevant to the origin and history of all the world's oceans--theories that will help the Office interpret existing geologic structure and trends." Such understanding could become a scientific base for diagnosing the meaning of soundings and other survey data. NOO uses this information to chart the lands lying beneath the world's oceans and seas.

Like all deep-ocean regions, the sea floor beneath the open Atlantic is largely unexplored--at least as far as photographing it is concerned. So, Jahn recalled, "we lowered the camera to the bottom at 77 different Atlantic stations to get random shots--to see what could be found, and the 'Umbellula' (his name for it) appeared on Station 59."

The 'Umbellula'

The photo shows the Umbellula as a tentacled animal atop a slender stalk, which Jahn estimates to be about three feet long. The tentacles end in clusters of large flower-like polyps, or "feet," said to be deep red, shading toward orange-red or purplish red.

"These agile tentacles," Jan reports, "capture food floating by the Umbellula and pass their catch to the creature's center mouth. The tentacles also may serve as a defense against enemies. The Umbellula supports itself on the bottom by imbedding a long, hollow muscular bulb at the end of its stem into the soft sea floor mud."

NEW-TYPE DRIFTING BUOY SET ADRIFT ON GEORGES BANK

BCF's 'Albatross IV' set adrift a buoy on Georges Bank in March. On command of the NIMBUS satellite, the buoy radios its position and the water temperature to the satellite. The latter radios the data to a ground station. A series of such positions traces the surface current.

The Woods Hole (Mass.) Oceanographic Institution is responsible for U.S. Navy-developed buoys. The Institution requested BCF's Woods Hole Laboratory to select the location for the buoy. It did--in an area over the haddock spawning grounds.

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ANTARCTICA ONCE JOINED TO S.E. AFRICA, SCIENTISTS SAY

Two ESSA scientists, Dr. Robert S. Dietz and Walter Sproll, report they have established with a computer's help, that Antarctica once was attached to Africa's southeast coast. The continents now are 2,000 miles apart.

About 200 million years ago, they estimate, there was only a single universal land mass called Pangaea, 80 million square miles in area. Then, for still-unclear reasons, Pangaea started to rift apart, like an ice floe breaking up. The fragments--today's continents--were dispersed to their present positions. The split between Africa and Antarctica apparently was one of the first events to occur.

Support Continental Drift Theory

Dietz and Sproll support the continental drift theory. This postulates that the continents are drifting at rates of about an inch a year in the earth's mantle. The mantle is that part of the earth's interior lying between the molten central core and the crust.

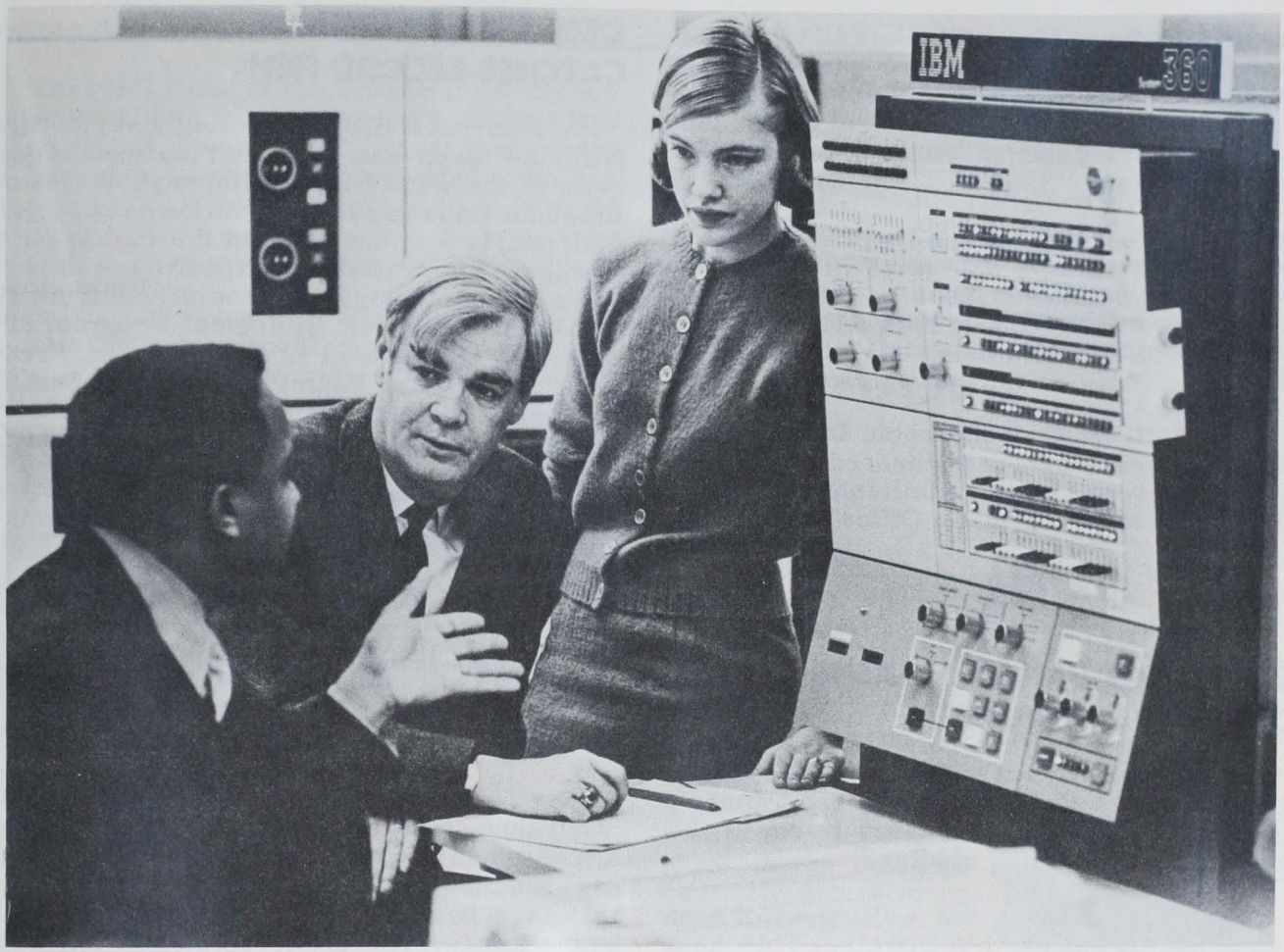
COMPUTER USED TO STUDY WORLD'S OCEANS

Scientists are using a computer at the National Oceanographic Data Center (NODC), Washington (D.C.) Navy Yard, "to unravel many of the mysteries locked in the cold and silent depths of the seas." Its electronic files contain an estimated 85% of world's known oceanographic station data, and are the largest collection of such information in the U.S.

The computer helps "chart the paths of 'rivers' that flow through the sea, measure the closely related effects of the world's oceans on global weather, even track the life cycle of a single drop of sea water."

Many Requests for Data

"A few months ago," said Dr. Thomas S. Austin, Director of the Center, "a scientist asked for all our data on a triangular section of the Atlantic from Gibraltar to the Azores to the coast of Scotland. He wanted readings from the surface down to 10,000 feet.



Dr. Thomas S. Austin (center), Director, National Oceanographic Data Center, James Pugh, computer operator, and Mrs. Charlotte Sparks, a programmer, with IBM System/360 Model 40. Its electronic files contain the largest U. S. collection of oceanographic station data.

"With this kind of information, he plotted the two-way flow of water into and out of the Mediterranean--eastbound for the upper layers of the water and westbound as the water gets deeper."

In another case, the Center's information on the effects of polar icecaps was needed. The freezing action in Arctic and Antarctic areas removes salt from water and makes it heavier. Then, the colder, heavier water flows along layers of equal density. It results in the creation of 'rivers' of colder water coursing along the ocean bottom.

Dr. Austin points out: "A drop of seawater has a life cycle that can be traced with information stored in the IBM computer."

The cycle can take thousands of years. It starts with the chemical combination of hydrogen and oxygen in the atmosphere as precipitation. "Precipitation enters the seas directly as rain, fog, or mist, or through runoff from rivers. It completes the cycle through evaporation by the sun."

NODC's Many Sources

NODC's information comes from many sources: world's navies, private shipping, scientists, oceanographic vessels, government agencies, and oil companies.

According to Dr. Austin, the data's completeness, currency, and availability are the system's key elements.

Nansen Bottles & Other Devices

Until recently, water samples were gathered mostly in Nansen bottles lowered by cable over the side of a ship. The bottles also have thermometers to take temperatures at

various depths. The analysis of the contents of these samples yields information on the amounts of nutrients and chemical elements, the presence of plankton and other small marine life, and the subsurface currents' direction and speed.

In the past few years, the use of sophisticated continuous-recording devices on ships, buoys, and satellites has increased. Also, more computers aboard oceanographic vessels have increased information supplied to NODC.

The National Oceanographic Data Center, founded 9 years ago, is sponsored by 10 government agencies and administered by the U.S. Naval Oceanographic Office.

EXTRA-HOT PANAMA BASIN OF PACIFIC IS STUDIED

Oceanographers of ESSA's Coast and Geodetic Survey, aboard the 'Oceanographer', this month are seeking "answers to one of the earth's most puzzling riddles."

They are studying the welling up of heat from within the earth's bowels. This heat warms the water below the sea as it moves northward from the frigid Antarctic.

Scientists know little about the process by which this thermal energy moves upward after it escapes the earth's crust. But the basin ESSA's oceanographers are probing provides an unusual laboratory.

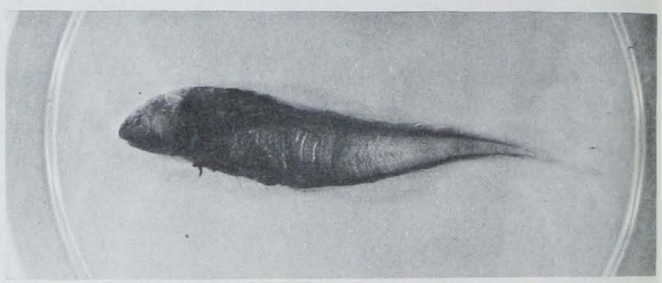
The Panama Basin

It is a 600-by-600 mile, 9,000-foot-deep, basin at the bottom of the Pacific, hemmed in by undersea mountains, and known as the Panama Basin. ESSA says: "The heat that rises in it from within the earth is estimated to be three times greater than the average rate elsewhere in the world's oceans. Furthermore, the basin floor is marked by abrupt pit-like deeps, ridges and escarpments which provide a wide range of conditions for examining the circulation phenomena."

The Panama Basin lies between the coasts of Central and South America and the Galapagos Islands. The islands are on the equator, about 600 miles west of Ecuador.

DEEP-SEA EXPEDITION CATCHES RECORD FISH

A depth record for collecting a vertebrate from the deep sea has been claimed by the crew of the 'John Elliot Pillsbury'. A fish of the genus Bassogigas was trawled from 26,132 feet, nearly 5 miles down, in the Puerto Rico Trench. The Pillsbury expedition was part of the National Geographic Society/University of Miami Deep-Sea Biological Program directed by Dr. Gilbert L. Voss and Dr. Frederick M. Bayer of Miami's Rosenstiel School of Marine and Atmospheric Sciences.



Bassogigas--trawled from 26,132 feet by R/V Pillsbury. (Photo: Don Heuer)

Dr. Voss, expedition's chief scientist said: "Only three or four specimens of Bassogigas are known in world biological collections, and our specimen is in the best condition of any that have been collected, as well as having been taken from the deepest water." The fish is about $6\frac{1}{2}$ inches long and, though it inhabited an area of total darkness, has two small eyes.

The remains of a squid which probably had reached 15 to 18 feet also were collected from the Puerto Rico Trench. The scientists say it is the first-known record of the carcass of a large animal taken from the ocean deeps.

The scientists say the Pillsbury is the only vessel in the U.S. oceanographic fleet fully equipped for trawling at these depths. Her main winch has two reels of $\frac{9}{16}$-inch wire; each reel contains 42,000 feet. As much as 35,840 feet were used to make the tows.

Pollution $4\frac{1}{2}$ Miles Down

The Pillsbury's scientists reported: "Man's efforts to pollute the earth were evidenced by some of the other items brought up when tows were made in water $4\frac{1}{2}$ miles deep. From the ocean bottom came empty paint cans, fruit juice cans, flip-top lids of beer cans, clinkers from steamship fire-rooms, pieces of old aluminum, empty bottles, and flashlight batteries."

Puerto Rico Trench

The level floor of the Puerto Rico Trench consists of soft, blue, extremely sticky clay. "The clay is covered with the largest amount of land plant material yet reported from any trench in the world. Pillsbury tows brought up coconut husks, tree seeds, fronds, tree branches, mangrove roots, and turtle grass remnants."

The Trench probably has "the most uniform, unchanging environment known in the Atlantic Ocean." At $4\frac{1}{2}$ to 5 miles down, there is no light from the sun, temperature is slightly below 2° C., and pressure is 800 times greater than on earth's surface. The Trench is over 200 miles long; at its widest point, it is almost 40 miles. At its deepest, the Milwaukee Deep, it is about 28,700 feet (4,780 fathoms).

The National Geographic Society/University of Miami Deep-Sea Biological Program investigates "the kinds, distribution, and concentration of marine life in the tropical waters of the Atlantic Ocean from West Africa to the coast of South America and the Caribbean Sea."

DR. J. L. McHUGH APPOINTED IDOE COORDINATOR

Dr. J. L. McHugh, the former deputy director of BCF, has been appointed head of the new Office for the International Decade of Ocean Exploration (IDOE) by Dr. William D. McElroy, director of the National Science Foundation.

The IDOE is an international effort to expand the uses of the oceans--and to design ways to protect the marine environment from degradation.

IDOE's first year will concentrate on three areas: identification of factors that will help man predict modifications in the oceans caused by nature or by man; investigation of specific oceanic areas with special attention to food chains and pollutants; and studies of selected areas of the ocean bottom to improve man's knowledge of it, and to facilitate location of natural resources.

Dr. J. L. McHugh

FOREIGN FISHING OFF U.S. IN FEBRUARY 1970

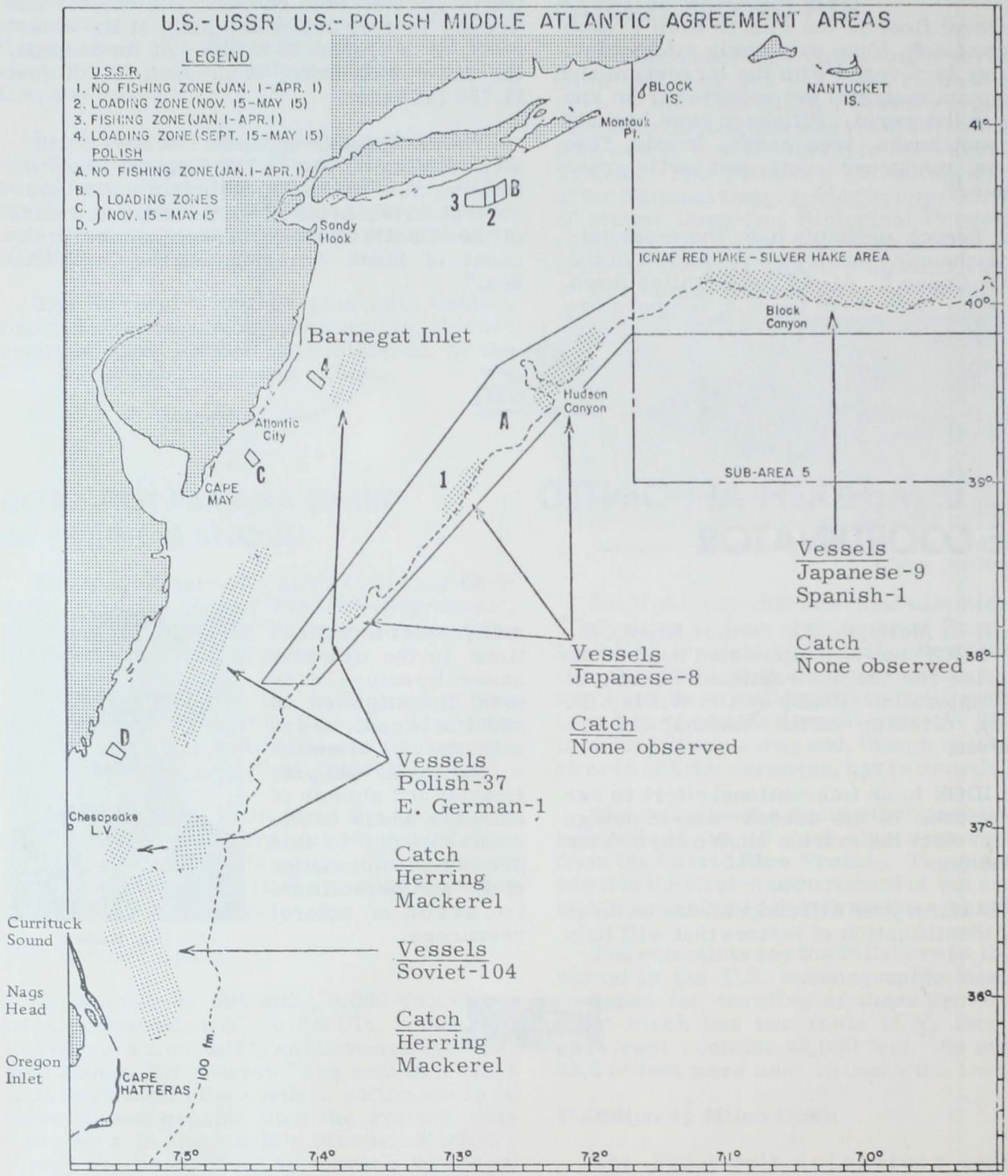


Fig. 1 - Foreign-flag vessels fishing off southern New England and Georges Bank, Feb. 1970 (shows no. of vessels and species fished).

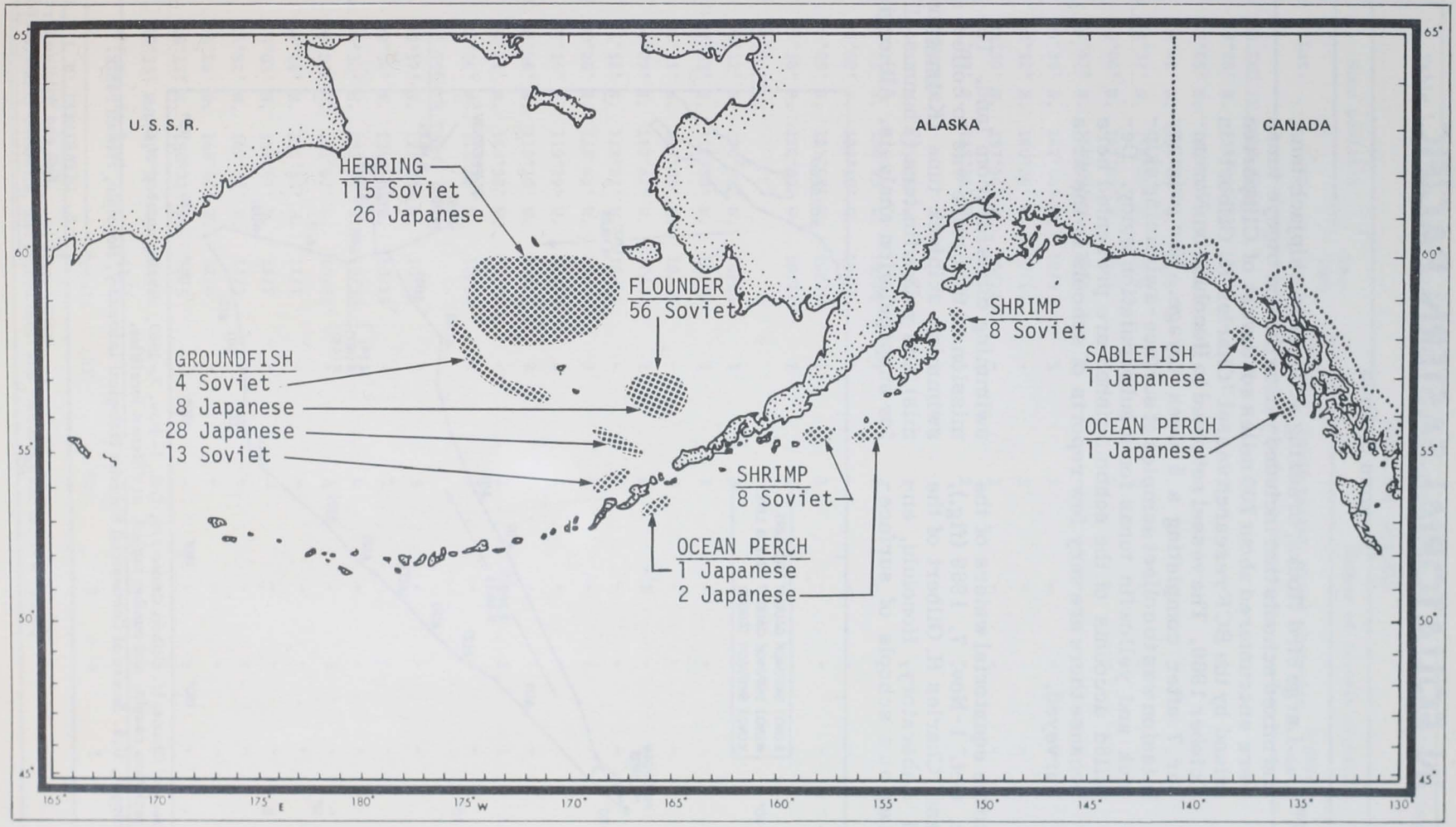


Fig. 2 - Foreign fisheries off Alaska, February 1970.