



Unloading catch aboard BCF's 'Albatross IV'. (R. K. Brigham)

FORECAST GROUND FISH ABUNDANCE ON NEW ENGLAND BANKS

The abundance levels of groundfish species fished by New England fishermen are expected to show patterns of change in 1970, reports Russell T. Norris, Director of BCF's North Atlantic Region.

- Haddock and whiting are expected to continue at low levels of abundance.

- Cod, ocean perch, and industrial fish species are expected to equal or exceed 1969 levels.

- The yellowtail flounder has been at high level, but there are signs of somewhat lower abundance in the next years.

Information by BCF Biologists

These forecasts were based on information provided by biologists of BCF's Woods Hole (Mass.) Laboratory. They normally monitor landings by commercial fishermen. They also study populations of fish and shellfish on off-shore banks by samples taken by BCF's 'Albatross IV.'

Georges & Browns Bank Haddock

The vessel's annual fall groundfish survey showed 1969 year-class of haddock was poor on Georges Bank. It was the sixth continuous year of very low indexes. As a result, low abundance was expected to continue for at least three years.

On Browns Bank, the survey showed abundance of 1969 year-class haddock had improved over previous years. Because of previous poor year-classes, however, abundance was expected to decrease for the next three to four years.

ICNAF Conservation Measures

As conservation measures for haddock on Georges and Browns Banks, the International Commission for the Northwest Atlantic Fisheries (ICNAF) has instituted catch quotas and closed seasons. It is hoped these measures will aid recovery of depleted haddock stocks off New England.

GEORGES BANK HADDOCK SPAWNING IS WATCHED CLOSELY

The success of haddock spawning on Georges Bank and Browns Bank again is being followed carefully by biologists of the BCF Woods Hole Biological Laboratory and Canadian Biological Station, St. Andrews, New Brunswick.

The Georges Bank area is of particular interest this season. It used to be the primary producer of haddock, but now the population is at an all-time low. Haddock born in 1963 and age seven in 1970 are still the mainstay of the Georges Bank fishery. Haddock-spawning studies underway at the Boston Fish Pier and aboard research vessels surveying the fishing banks could provide earliest evidence of the emergence of a large year-class.

General Conclusions

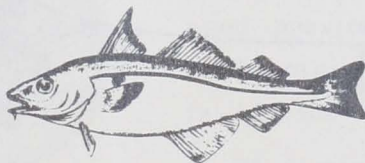
By frequent examination of samples of haddock gonads, it has been possible to monitor the progress of spawning--and to draw these general conclusions about the duration of the spawning season on Georges Bank:

1. The largest haddock spawn first, usually in shoal water on top of the banks, both in-shore and offshore.

2. Prior to onset of spawning, ripening haddock of all sizes are found in deep waters along Northern Edge of Georges Bank and in South Channel. The maturity of fish from deep water usually is one or two stages behind those from the shoals.

3. Ripening of fish and their movement from deep water seem associated with seasonal warming of bottom waters. However, this does not explain the early spawning of large haddock on the shoals.

4. The number of immature haddock in the samples has decreased steadily since sampling began in 1968. Less than 2% of fish sampled through March 1970 have been immature.



BCF LOOKS FOR BLUEFIN TUNA

"Bluefin tuna are great travelers," confides BCF La Jolla, Calif. Fish tagged and released in the California fishery have been recaptured several years later off Japan. During late spring, the bluefin visit the waters off southern Baja California. In 1969, U.S. fishermen caught 7,500 tons of the highly prized fish.

Waiting for the bluefin this year as they approached the coast were oceanographers and fishery biologists of the BCF La Jolla laboratory and the Scripps Tuna Oceanography Research program (STOR). They had left San Diego on April 13 aboard BCF's 'David Starr Jordan', led by Dr. Maurice Blackburn of STOR, on a 21-day, 4,100-mile cruise. Its purpose, explained Dr. Alan R. Longhurst, director of BCF La Jolla, was to give the tuna industry up-to-date information on the oceanographic mechanisms that determine routes of bluefin tuna into the coastal region--hence, the location the fishery would open in 1970.

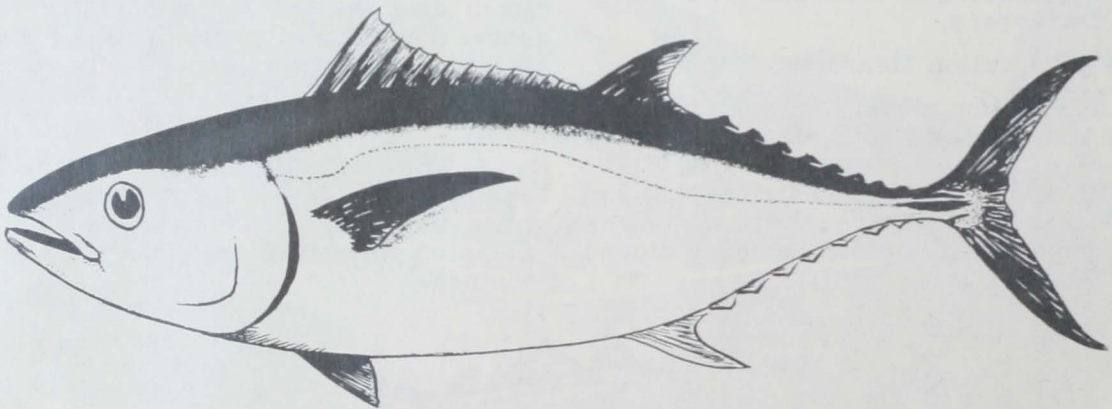
Equipment Used

Ninety percent of bluefin tuna are caught in 62°-70° F. water, beginning in late May each year. Almost nothing else is known about their environmental preferences.

The scientists hoped to locate offshore bluefin by longlining, basing the fishing tracks on the long-term mean position of the 62° and 70° isotherms. They were using a battery of oceanographic, biological, and meteorological instruments to measure the ocean environment--and to attempt to relate findings to tuna fishery.

Early Information Important

The information on bluefin distribution weeks before they normally reach Baja California has immediate practical value to U.S. tuna fishermen. These fishermen were looking for alternate resources because the yellowfin tuna quota had been filled for 1970. Locations of any bluefin catches would be radioed to La Jolla by the David Starr Jordan. The information would be passed on to southern California tuna fishermen.



AMERICANS EAT MILLION POUNDS OF SHRIMP A DAY

In 1968 and 1969, Americans ate a million pounds of shrimp a day. In 1969, consumption of shrimp in all forms was 361.6 million pounds, heads-off weight. This was a drop of 1.3% from 1968's record 366.2 million pounds. Nevertheless, shrimp remained unchallenged as the most popular shellfish.

On a per-capita basis, Americans are eating about twice as much shrimp as they did in years immediately following World War II.

Reasons for Growth

BCF economists say no single answer explains why Americans are eating more shrimp. Contributing factors have been rising purchasing power, growing popularity of shrimp, new products, wider distribution, improved quality, and more promotion.

U.S. Shrimp Industry

The U.S. shrimp industry is located primarily in the Gulf and South Atlantic States. Additional supplies come from New England, Pacific Coast, and Alaska. The U.S. also imports large quantities. In recent years, Latin American and Asian countries have supplied larger quantities.



BROWN SHRIMP REARED IN ARTIFICIAL MEDIA

Techniques for rearing larval penaeid shrimp that were developed at the BCF Biological Laboratory, Galveston, Texas, continue to pay dividends. In a recent experiment, about 250,000 brown shrimp were reared to postlarvae from eggs spawned in the laboratory. Survival rates of up to 84% were observed as the young shrimp developed from the naupliar to the postlarval stage.

Maintained in 250-gallon tanks, one batch of shrimp was cultured in a completely defined medium consisting of distilled water with an artificial sea salt added. This technique interests scientists working with larval shrimp nutrition because of the possibility that the larvae may absorb organic molecules directly from the water. It also provides a method of culturing shrimp larvae that can be duplicated at any laboratory--and is not dependent upon unknown characteristics of the water.

Greater Densities Obtained

Cultures of the diatom *Skeletonema*, used as food for the larval shrimp, were maintained in tap water and the artificial sea salt. Densities of 8,000,000-10,000,000 cells per milliliter of water were obtained. Previously, maximum densities were 300,000-500,000 cells per milliliter in natural sea water. The variable chemical nature of the sea water used previously made it difficult to obtain optimum concentrations of the nutrients utilized by the diatoms.

Of all postlarval shrimp harvested, about 100,000 were supplied to five organizations involved in research on shrimp mariculture.

HAWAII'S COMMERCIAL FISH LANDINGS DROP BUT VALUE RISES

Commercial landings of fish and shellfish in Hawaii during the 1968-69 fiscal period totaled 11,096,116 pounds worth \$3,378,553 to the fishermen--a decrease of 1,733,210 pounds, or 13.5%, from previous year. However, generally better prices prevailed, so overall value rose \$124,931 (3.8%).

Ups & Downs

The lower total harvest was due largely to decreased landings of aku (*Katsuwonus pelamis*). These dropped 1,453,033 pounds, or 16.1%. Other important fisheries fell too: yellowfin tuna (*Neothunnus macropterus*) by 108,262 pounds (23.3%), akule (*Trachurops crumenophthalmus*) 215,826 pounds (20.8%), and striped marlin (*Makaira audax*) 172,572 pounds (35%).

Fisheries that increased were: bigeye tuna (*Parathunnus sibi*) by 95,552 pounds (19.5%), and opelu (*Decapterus pinnulatus*) by 53,811 pounds (27.7%).

Oahu Led

Oahu led the islands in landings with 9,027,407 pounds, or 81.4% of total State landings, followed by Hawaii, 897,134 pounds (8.1%), Maui with 847,269 pounds (7.6%), Kauai 282,830 pounds (2.5%), and Lanai and Molokai combined, 41,476 pounds, 0.4%.



PRAWN CULTURE IN HAWAII PROGRESSES

The development of techniques to mass-rear the giant, long-legged, fresh-water prawn (shrimp), '*Macrobrachium rosenbergi*', continued in Hawaii during July 1968-June 1969. This was reported to Governor Burns by the Department of Land and Natural Resources.

During that year, 700,000 juvenile prawns were produced--500,000 more than in the previous year. The planners believe this "demonstrates that sufficient numbers of young prawns can be propagated to supply commercial prawn farmers." They are concentrating now on reducing production costs from \$6.47 per thousand to about \$2.

Fishpond Owners Cooperate

The number of privately owned fishponds cooperating with the Division of Fish and Game to test-rear young juveniles to market size rose from 2 to 9. The ponds are $\frac{1}{4}$ to 6 acres; combined surface area is about 100 acres. About 207,000 juvenile prawns were stocked. The use of supplemental feed improved growth rate of pond-raised prawns. It used to take 2 years to raise a prawn from egg to market size; now, just over 1 year.

Wild Stocks

In continuing attempts to establish wild stocks, 128,000 prawns were released into streams throughout Hawaii.



DR. GLASGOW URGES ADOPTION OF EFFECTIVE FISH DISEASE CONTROL PROGRAM

Dr. Leslie L. Glasgow, Assistant Secretary, Fish and Wildlife, Parks, and Marine Resources, U.S. Department of the Interior, testified before the Energy, Natural Resources, and Environment Subcommittee of the Senate Commerce Committee, March 13, on the need for a fish disease control program.



Dr. Glasgow said:

Efforts to control fish diseases in this country were begun a century ago by Spencer Fullerton Baird, the first Commissioner of the U.S. Commission of Fish and Fisheries. In 1898, the Commission requested Congress to authorize a full time fish pathologist. In 1915 the position was authorized and the study of fish diseases has been an important function ever since. The Bureau of Sport Fisheries and Wildlife in 1968 expended 380,000 dollars on fish disease research and 120,000 dollars on fish disease control in national fish hatcheries. Yet these are minuscule amounts in relation to the total values of our fish resources.

Value of Hatchery & Pond Fish

In 1966 alone, the Pacific salmon and steelhead trout caught by commercial and sport fishermen were valued at 28.5 million dollars. At least 55% of the salmon and steelhead catch originated in either a State or Federal fish

hatchery. Commercial hatcheries in 1968 produced 18 to 20 million pounds of trout valued at 11 million dollars. In the South Central States fish farmers produced 40 million pounds of channel catfish valued at 12 million dollars, and 40 to 50 million pounds of bait minnows valued at 50 million dollars are produced annually. The stocking programs carried out by State and Federal fish hatcheries provide one third of the sport fishing in the United States and result in 943 million dollars being spent for recreation with a total contribution of 3.9 billion dollars to the gross national product of the United States.

Fish Resources Threatened

As the industry continues to grow, the lack of attention to matters of fish health on both the state and national level brings us to the point where our fish resources are threatened by uncontrolled diseases.

There are a number of serious fish diseases, some of which are causing losses in the United States, and at least two diseases, currently rampant in Europe, that have not been introduced into North America. These diseases include whirling disease, infectious pancreatic necrosis, viral hemorrhagic septicemia, corynebacterial kidney disease, infectious hematopoietic necrosis, virus disease of channel catfish, *Ceratomyxa* infection of salmonids, *Minchinia* infection of oysters, microcell disease of mollusks, molluscan neoplasm disease and French mycelial disease of oysters.

Whirling Disease Closes Hatcheries

Whirling disease has had a serious impact wherever it has occurred. Authorities in Pennsylvania report that this disease caused the closing of five commercial trout hatcheries which had a combined production worth over 250,000 dollars wholesale. The hatcheries were forced to close because the disease had infested the ponds to the point where, without expensive rehabilitation, they were useless for further production of trout.

In New Jersey, whirling disease had been a problem since July 1967. Brook trout production at a major State installation was reduced by 40 percent and expensive changes in hatchery operations were required.

The recent confirmation of whirling disease in the State of Michigan caused the Department of Natural Resources to impose on August 30, 1968, a quarantine on all fish-rearing firms in the State. Investigations are still in progress and there is concern that the disease might spread to the highly popular coho salmon in the Great Lakes.

Even closer to home, whirling disease was found at the Lahontan National Fish Hatchery in November 1969. We will have to destroy three quarters of a million cutthroat trout. In addition, we have lost 12,000 cutthroat broodstock. It took us ten years to develop this broodstock. The Lahontan cutthroat trout is considered an endangered species by the International Union for Conservation of Nature and we regret having to take such drastic measures with an endangered species.

Infectious Pancreatic Necrosis

The Bureau of Sport Fisheries and Wildlife has records of outbreaks of infectious pancreatic necrosis from at least 23 States, several Provinces of Canada, and from France and Denmark. The disease directly affects the output of commercial, State and Federal fish hatcheries whenever it occurs. Following an outbreak, facilities must be disinfected and the fish must be replaced. If the fish are replaced with eggs, a delay of several months in the production program is encountered. This is a great setback, particularly for the small commercial producer. Egg producers are especially hard hit when IPN occurs since, in most cases, valuable broodstocks must be destroyed and a loss of consumer confidence often results.

Interior's Authority Fragmentary

The existing authority of the Secretary of the Interior to control fish diseases is fragmentary.

The Lacey Act of 1900 gives the Secretary the authority to regulate the importation of fish and wildlife to protect the resources of the United States.

Under the Lacey Act, Title 50, CFR, Part 13.7 was revised on December 21, 1967, to

prevent the introduction of two fish diseases into this country.

The Black Bass Act of 1926, as recently amended in 1969, prohibits importation or transportation in interstate or foreign commerce of fish in violation of foreign, State, or other law.

The 1934 Fish and Wildlife Coordination Act, as amended in August 1958, authorizes the Secretary to provide assistance to and cooperate with Federal, State, and public and private agencies and organizations in the development, protection, rearing and stocking of all wildlife resources and in controlling losses from disease.

The Act of March 15, 1958 (16 U.S.C. 778-778c) authorized the Secretary of the Interior to establish fish farming experimental stations to conduct research on methods of fish farming including the control of fish diseases. Two such stations have been established in the Bureau of Sport Fisheries and Wildlife.

The Act of September 2, 1960 (16 U.S.C. 753a-753b) authorized the Secretary of the Interior to enter into cooperative agreements with colleges and universities, with State game and fish departments, and with non-profit organizations, relative to the establishment of research and training programs for fish resources. There are 23 cooperative fishery units operated by the Bureau of Sport Fisheries and Wildlife.

The Act of August 9, 1962 (16 U.S.C. 760j-760j) authorized the Secretary of the Interior to assist the States in developing disease resistant oysters. The Bureau of Commercial Fisheries now operates this and other disease control programs under PL 88-309. Under the disaster clause of this law, the State of Michigan received 65,000 dollars to control whirling disease, but a similar request by the State of California for 400,000 dollars to control a virus and a parasite disease at a State hatchery was denied because of a shortage of funds.

Senate Bill Useful

None of the above Acts was specifically intended to promote the control of fish diseases, and all of these collectively are still inadequate. S. 1151 includes in one piece of legislation the authority to set up and operate an effective fish disease control program.

MAN COMPETES WITH OTHER FOR ADAPTION

The bill authorizes the Secretary of the Interior to:

- (1) Control the interstate traffic of diseased fish.
- (2) Inspect premises and conveyances.
- (3) Compensate the owner for fish which must be destroyed.

The bill also instructs the Secretary to prepare regulations to:

- (1) Control the traffic of diseased fish.
- (2) Set up methods whereby fish diseases can be eradicated.

Under such authority I believe that the menaces of fish diseases can be effectively reduced and finally eliminated. We urge early enactment of this legislation.



HICKEL PLEDGES LAKE ERIE CLEAN-UP

Secretary Walter J. Hickel announced on April 21 that Interior Department was initiating a campaign to clean up Lake Erie. This followed reports of lethal discharges of mercury into the lake --and into the Detroit River, which empties into Lake Erie.

He said he was distressed by the economic losses and possible health hazards to residents of Lake Erie area by mercury contamination of fish.

Secretary Hickel moved on these fronts:

- An enforcement conference on Lake Erie will be reconvened in Detroit. It will be followed by enforcement workshops in Toledo, Cleveland, Lorain, Dandusky, and Ashtabula, Ohio; Erie, Pennsylvania; and Lackawanna, New York.
- Increased monitoring and research will begin on the toxicity of mercury and other metal compounds, and their effect on fish and other aquatic life. The work will be done by BCF Ann Arbor, Michigan.

• The Federal Water Quality Administration (formerly Federal Water Pollution Control Adm.) has been directed to identify and list all toxic substances being discharged into U.S. waters.



CONFERENCE ON ENVIRONMENTAL POLLUTION SCHEDULED

The Department of the Interior will sponsor a 4-day conference and exposition on environmental pollution at the Sheraton Park Hotel in Washington, D.C., Sept. 29-Oct. 2.

Secretary Walter J. Hickel said the conference was being called in response to President Nixon's call for "a total mobilization" to clean up the environment.

More than 3,000 leaders from industry, government, national organizations, and universities are expected to participate.

Hickel's Statement

Secretary Hickel said: "In his message to the Congress on the environment on February 10, President Nixon said that the task of cleaning up our environment calls for a total mobilization of all of us--involving governments at every level and requiring the help of every citizen.

"We hope to make this conference a productive answer to the search for new and more efficient methods, approaches, and techniques for winning the battle for a better national environment.

"Our purpose is not only to focus national attention on the threat to our environment but to help muster a nationwide effort in corrective actions to improve it."

Exhibits

At the concurrent national exposition, the participating groups will be invited to display pollution abatement equipment, techniques, and services.



MAN COMPETES WITH OTTER FOR ABALONE

Wallace Turner

(This article appeared in The New York Times May 10.)

In San Francisco, a waterfront diner raises a bite of the succulent, delicately flavored shellfish to his mouth and chews dreamily as he gazes out at the boats bobbing in the swells.

A hundred miles or so to the south, a sea otter slumps comfortably on his back as he rides the swells of the open sea and with quick, tiny bites rips through the rubbery flesh of the same kind of shellfish.

They are competing, the sea otter and the gourmet, for a dwindling population of abalone, a prized shellfish that grows amid the kelp beds on the rocky sea floor along the central California coast.

To the competitors themselves, the abalone simply means choice food. But both sides have allies in the turbulent world of conservationist and economic pressures, and to them serious issues are at stake.

Seek Thinning of Herd

Working for the gourmet are the divers who walk the sea floor in search of the abalone and the processors who slice the meat and pound it for tenderizing. They have sought legislation to permit the thinning of the otter herd as a means of protecting the abalone fishery.

And speaking for the small furry sea animals is Margaret Owings, president of Friends of the Sea Otter, a group demanding that nothing be allowed to interfere with the natural growth of the otter population.

Mrs. Owings, the wife of Nathaniel A. Owings, the architect, directs her campaign from Wild Bird, one of the nation's most stunning homes, designed by her husband and built on a point hundreds of feet above the surf of Big Sur.

From her balcony she can see a crescent of sand that is a sunning place for a herd of sea lions and a kelp bed that is home for a half-dozen sea otter. Gray whales pass sometimes just outside the kelp.

'Man and Wildlife'

"We're not just dealing with otter," Mrs. Owings said in a recent interview. "We're dealing with the whole question of man and wildlife. If we lose this one, we've lost a foothold on future attempts to preserve a rare species."

Far to the north, a larger band of sea otter wanders around Amchitka Island in the fog, cold and gloom of the outer Aleutian chain. It feeds heavily on sea urchins, who have no friends.

The smaller herd to the south, regenerated from a few individuals that escaped the fur hunters of the 18th and 19th centuries, now number about 1,500 between Morro Bay and Monterey.

They are increasing at the rate of 4 to 6 per cent a year, and they are gobbling up the abalone. Mrs. Owings argues that a part of the decrease in abalone comes from overharvesting by divers, but she agrees that "we know perfectly well that the otter like abalone."

The divers who go down in bulky suits, trailing yards and yards of rubber hose, to pry the abalone from the rocks have great respect for their rivals' fishing skill.

'Don't Waste Any Time'

"I remember the first time I saw an otter break an abalone with a rock," said Ernest Porter, who has been diving for about 20 years. "They don't waste any time with it. They get a rock, and just like a carpenter nailing a board, they know what to do with it."

The Pacific coast abalone grow large enough for their edible portions to weigh as much as five or six pounds. But the seven-and-three-quarters inch size that may be harvested commercially usually produces about two to two-and-a-half pounds.

"Of course the sea otter doesn't understand about the limits," said Dr. H. G. Orcutt,

laboratory supervisor for the California Fish and Game Department. "He eats any abalone he can get."

The abalone has an oval shell top and travels on a snail-like "foot" that holds it to rocks, along which it moves, slowly feeding on the leaves that fall from the kelp.

While divers must use a steel bar to pry it free, the sea otter simply takes a rock and breaks the shell so that the abalone loses its grip and can be carried to the surface and eaten.

Hunt Other Shellfish

The otter also hunt other shellfish. They break clams open by banging them together until they crack, and they handle a dungeness crab by holding one pinching claw while eating the other, then eating the one that was held, and then ripping off the bottom shell to clean out the crab's insides.

The otter live in a cold sea. They lack the fat layer that protects the sea lion, harbor seal or whale, but they have a thick fur that they constantly preen to prevent heat loss.

And they eat. A sea otter will consume his weight of 45 to 75 pounds in shellfish in three or four days. After a complex calculation, and allowing a wide margin for variables, Mr. Odemar, the fish and game biologist, estimated that one herd of 97 otter in one year ate between 627,800 and 1.15 million pounds of abalone.

There is no question that the supply of abalone is disappearing. The divers maintain that abalone disappear wherever the otter population is found as it moves slowly southward from the fastnesses of the rugged coast along Big Sur. In 1957 divers limited themselves to 50 dozen each a day; now getting five dozen abalone is a struggle.

The divers work in water 20 to 70 feet deep, in a cold that after a couple of hours penetrates their black rubber suits, the lining and their bones so that they must go topside and warm up.

Water Rough All Year

The water here is rough the year around.

"Sometimes a surge in the waves will throw you 60 feet and up against the rocks," said Duane Brown, 35 years old, who five years ago left a dough mixing job in a Phoenix, Ariz., bakery to be an abalone diver.

He worked for eight hours that day to have about three hours on the sea bottom, and he brought back about \$41 worth of abalone. He dived alone, too, which means that any serious accident would have been fatal.

Charles Sites, who operates an abalone processing plant, pays \$18 a dozen for abalone. He said there were no more than 10 abalone boats, with about 20 divers, working out of Morro Bay now. In 1960 there were more than 50 boats.

"The otter have moved south and they just clean up the abalone," he said. The diving now centers near Santa Barbara, but divers here maintain that the otter will spread there and wipe out the marketable shellfish.

Abalone Sure to Survive

Biologists for the State Fish and Game Department say that the abalone species will not be wiped out, for they spread too many eggs for that. But they agree that a commercial fishery cannot exist alongside an unlimited herd of sea otter, who eat the abalone before they reach marketable size.

State Senator Donald L. Grunsky, who represents this area at Sacramento, introduced a bill this year that would have allowed state biologists to capture and try to move the otters to keep population down.

After hearings at which Mrs. Owings and other friends of the otter testified, he asked that his bill be turned into a study proposal, which means the end of it for now.

Charles Sites' wife spoke in good humor of "our group that we called Friends of the Abalone."

"We had a little money and opened a checking account, and a while back we wrote a check for \$10 and it bounced," she said. "We'd forgotten about the service charges."



RENOWNED SCOTTISH MARINE BIOLOGIST VISITS BCF OXFORD LAB

Dr. C. Maurice Yonge, a world leader in marine biology, toured BCF's Biological Laboratory at Oxford (Md.) on April 13 and presented an informal seminar.

Dr. Yonge holds the Regius Chair of Zoology at the University of Glasgow, Scotland. He is president of the Scottish Marine Biological Association. He received his doctorate from the University of Edinburgh in 1922 for original studies of food and feeding in 'Mya arenaria'--the U.S. common soft-shell clam, or mannose.

His research career began at the Plymouth, England, marine biological lab where he studied metabolism in the European oyster.

In the late 1920s, he led an expedition to Australia's Great Barrier Reef. It resulted in significant contributions to marine science

and the founding of the Heron Island lab for continuing reef studies. He has worked at marine stations all over the world.

Classics of Marine Biology

Dr. Yonge's two most famous books, "The Oyster" and "The Sea Shore," are classics. The results of his research have influenced the direction of modern invertebrate biology. He is now interested in the relationship between the shape or anatomy of marine bivalves (oysters, clams, mussels) and their ability to adapt to the environment.

Oxford Seminar

His seminar at Oxford reviewed the world status of molluscan culture, or sea-farming. He related the development of aquaculture to biological events. He used personal observations from more than 20 visits to the U.S. and Canada as examples of dynamic changes in the shellfisheries.



James B. Engle, Chief, Shellfish Advisory Service (left), Dr. C. Maurice Yonge (center), and Arthur S. Merrill, Laboratory Director, BCF Biological Laboratory, Oxford (right).

This was Dr. Yonge's first visit to the Eastern Shore and he was impressed by its natural beauty and by the ever-present artifacts of the Bay fisheries. He was fascinated by the similarities between small U.S. villages, such as Oxford, and coastal villages in England.

Dr. Yonge lauded the European oyster as "the best in the world"--but he admitted the possibility that the U.S. oyster might be second best!



JAPANESE SHELLFISH AQUACULTURE AUTHORITY VISITS U.S.

Dr. Takeo Imai, Professor Emeritus Tohoku University and Director of Oyster Research Institute in Sendai, Japan, was a recent visitor to BCF Washington, D.C.

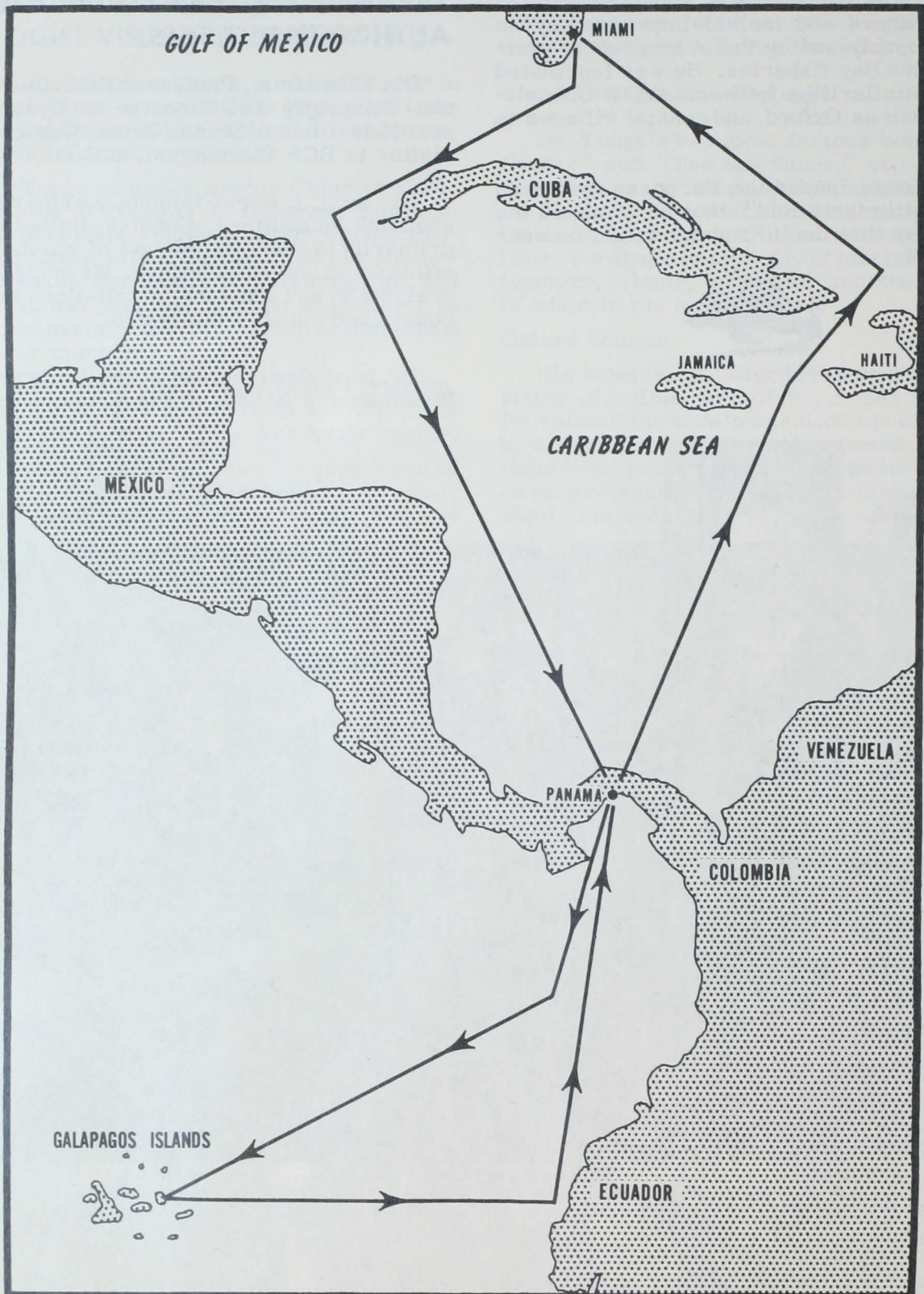
Dr. Imai, a world-famous authority on shellfish aquaculture, was in the United States primarily to study the effects of warm-water effluents on shellfish culture. He toured Federal, State, and industry installations on both coasts and the Gulf of Mexico.

Dr. Imai also lectured at the University of Washington's School of Fisheries in Seattle.



L to R: William N. Shaw, BCF, Oxford, Md., Neal Kelly, HEW, Washington, D.C., Dr. Takeo Imai, William M. Terry, Acting Deputy Director, BCF, Washington, D.C., James B. Engle, BCF, Oxford, Md., William Davis, BCF, Washington, D.C.

(Photo: Bob Williams)



Route of U.S. Coast & Geodetic Survey ship 'Oceanographer' during one-month cruise on which scientists from nine nations will attempt to establish an international standard for measuring ocean phenomena.

OCEANOGRAPHY

9 NATIONS SEEK STANDARDS TO MEASURE OCEAN & ATMOSPHERE

On April 30, 25 scientists from 9 nations sailed from Miami, Fla., aboard the 'Discoverer' to the Gulf of Mexico, Caribbean Sea, and Pacific Ocean in a 1-month attempt to establish international standards for measuring ocean and atmospheric phenomena. The Discoverer is an oceanographic 'floating laboratory' of the Coast and Geodetic Survey.

The scientists are oceanographers, physicists, and meteorologists from the U.S., the Soviet Union, Australia, Denmark, France, Japan, Norway, Great Britain, and West Germany.

Sea and air experiments are being conducted in and over the Gulf of Mexico and Caribbean Sea, and in the offshore waters of South America southwest of Panama. The ship will return to Miami via the Caribbean and the Sargasso Sea.

Measuring Sea's Productivity

Scientists from the U.S., Soviet Union, Australia, Denmark, France, Japan, Norway, and Great Britain are measuring the ocean's primary productivity. Essentially, this is a measure of the rate phytoplankton utilize radiant energy from the sun and nutrients from the sea to produce carbohydrates, oxygen, and other products through photosynthesis.

Incoming radiation at sea's surface and several levels below will be measured, together with the water's optical properties.

By bringing together scientists, measuring devices, and techniques from different countries, the planners aim to develop a means for intercalibrating the results--so measurements can be compared on an international basis. If a technique is agreed upon, it will be recommended to scientists throughout the world concerned with measurement of the sea's productivity.

Measure Radiation in Atmosphere

Meteorologists and technicians from the U.S., Soviet Union, Japan, and West Germany are attempting a comparable intercalibration of radiometersondes they use to measure ra-

diation in the atmosphere. The instruments, carried aloft by helium-filled balloons, radio back to the ship data on variations in radiant energy versus height above sea. Instruments of the 4 nations fly from the same balloon. So the scientists are measuring the same thing and will be able to intercalibrate their equipment.

The radiometersondes are measuring the thermal radiation emitted upward and downward from the atmosphere, and upward from the sea. As the balloons rise, the instruments gather data to provide a vertical profile of the variation in radiation. The radiation is emitted by water vapor, carbon dioxide, ozone, dust, and ice crystals in the atmosphere; radiation increases in intensity as temperature increases. Such data are considered vital for a useful understanding of what drives the global weather "machine."



PHOTOGRAPH MARINE LIFE AT ARCTIC BOTTOM

J. H. Kravitz, a geologist at the U.S. Naval Oceanographic Office (NOO) has presented photographic evidence that there is marine life even in near-freezing conditions on the bottom of Arctic waters. NOO says it probably was the first time it has been photographed.



Starfish live on Arctic bottom.
(Photo: U.S. Naval Oceanographic Office)

Kravitz reported: "We have a picture of brittle stars and starfish living on the sea floor at a point about 30 miles west of Franz Josef Land." He and 5 other scientists aboard the Navy icebreaker 'Atka' reached the far northern point in early autumn. At that season, the Arctic ice pack surrounding the 70 Franz Josef Land islands--all lie above western USSR in Barents Sea--yields somewhat to warmer temperatures.

Camera Near Sea Bottom

"But, even then, we had to ward off ice flows and small icebergs called 'growlers' to get this shot," Kravitz recalls. The camera system was lowered about 1,000 feet to a point about six to nine feet above the bottom. Then it was activated long enough to get 61 pictures "before the ice forced us to cut the camera run short and abandon the site." The photo on page 13 shows the marine animals living on a "rather smooth, tranquil bottom" close to the freezing point--0.52 degrees centigrade.

May Be First

According to Kravitz, the photo may represent "the first time scientists have ever used a camera aboard an icebreaker, or any surface ship for that matter, to photograph the ocean floor this far north, although photographs of the Arctic Basin have been taken from floating ice islands."



GULF OF MEXICO 'ESSENTIALLY SAME' AS 100 MILLION YEARS AGO

"The Gulf of Mexico is essentially the same now as it was 100 million years ago." That was the conclusion of scientists who completed Leg Ten of the Deep Sea Drilling Project.

"We found nothing in the Gulf to support or deny the theory of continental drift," said Dr. J. Lamar Worzel, Associate Director of Columbia University's Lamont-Doherty Geological Observatory in Palisades, New York. "Our findings do deny any continental drift occurring there for about the past 100-135 million years. Beyond that I cannot say, but up to that time the deep basin was there and

existed in essentially that same environment and location as it does today." Dr. Worzel was co-chief scientist with Dr. William R. Bryant, Texas A & M University, College Station, aboard the research vessel 'Glomar Challenger' during the cruise across the Gulf of Mexico from Galveston, Texas, to Miami, Fla.

A Theory About Gulf

Some geologists have theorized that the Gulf of Mexico once had been shallow and had sunk. Their estimates of when this happened range from 10 million to over 100 million year ago.

Scripps Institution of Oceanography, University of California at San Diego, is managing the Deep Sea Drilling Project under contract to the National Science Foundation. The Project is a part of the Foundation's Ocean Sediment Coring Program.



STUDY PESTICIDES DISCHARGED BY MISSISSIPPI R. INTO GULF

In April, researchers aboard the University of Miami's 'John Elliott Pillsbury' sampled and analyzed hydrocarbon pesticides in the water and bottom sediments of the Mississippi River delta and similar estuarine areas along the Gulf of Mexico's northeast coast.

Dr. Eugene F. Corcoran, Chief Scientist, said: "The Mississippi River is grossly modified as it flows nearly 2,500 miles from its beginning in a small lake in Minnesota to the Gulf of Mexico by the agricultural, industrial, and urban activities of a large complex society. When the river system discharges into the Gulf of Mexico, it carries with it much of the man-made pollution resulting from these activities. An important part of our expedition will be to show how the contaminated effluent is dispersed in the deep waters of the Gulf of Mexico, and what effect it has on the chemical and biological production in these areas."

The expedition also gathered information on the pesticide content of water taken from the Mississippi River delta for human consumption.

Chlorinated Hydrocarbons

The pesticides studied included DDT, dieldrin, aldrin, endrin, toxaphene, lindane, chlordane, and heptachlor. Almost insoluble, and extremely resistant to microbial degradation, these compounds can persist almost indefinitely in the water. They are also the most toxic to higher forms of aquatic life.

In addition to pesticides, the researchers also measured the salinity, oxygen, inorganic phosphates, nutrients, and trace metals at each sampling station.



U.S. COAST PILOTS 1 & 3 WILL BE UPDATED

The Coast and Geodetic Survey (C&GS) announced in late March that it will inspect navigational facilities and conditions between Eastport, Maine, and Cape Cod, Mass., and between Sandy Hook, N. J., and Cape Henry, Va., including Delaware and Chesapeake Bays.

Findings will be incorporated into new editions of "U.S. Coast Pilot 1, Atlantic Coast, Eastport to Cape Cod," and "U.S. Coast Pilot 3, Atlantic Coast, Sandy Hook to Cape Henry," scheduled for 1971. Eight of the nautical books are issued by C&GS; new editions are published at intervals of four to ten years.

The Information Furnished

Generally, the books furnish in narrative form information that cannot be shown graphically on marine charts--navigation regulations, weather, ice, freshets, routes, and port facilities.

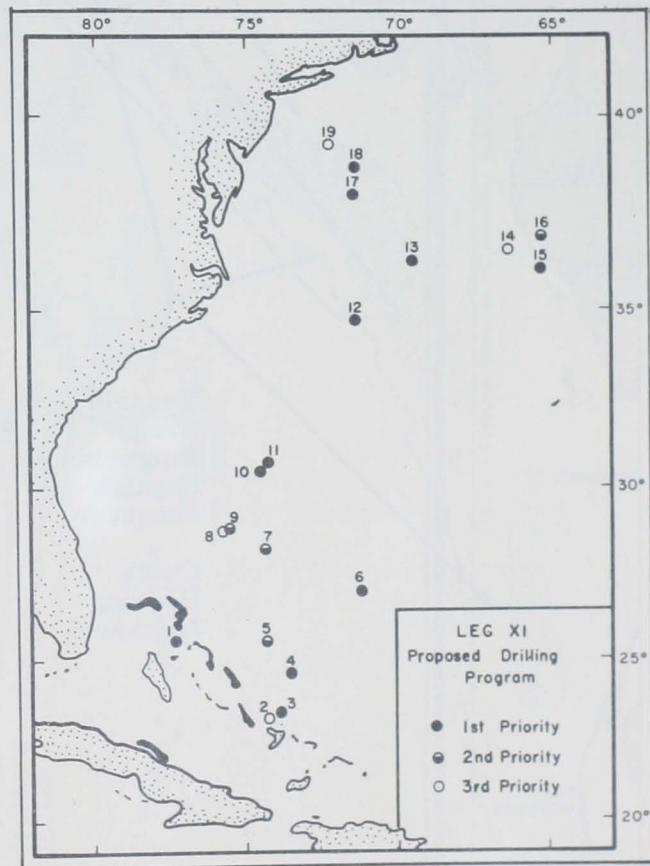
Coast Pilots and the annual cumulative supplements that keep them up to date are used by skippers of naval and commercial craft and by small-boat operators.



SPLIT OF EUROPE & N. AMERICA AGES AGO STUDIED

Deep-sea sediment now being recovered by the research vessel 'Glomar Challenger' during Leg Eleven of the Deep Sea Drilling Project is expected to produce scientific information on what happened millions of years ago when North America and Europe were pulled apart. Leg Eleven began in Miami, Fla., April 7, and ends in New York May 31.

Scientists are interested in what happened to the earth's crust as the continents tore apart. A major objective of the drilling is the investigation of this event by examining the oldest sediments in the Atlantic Ocean deposited when the continents separated.



FOREIGN FISHING OFF U.S. IN MARCH 1970

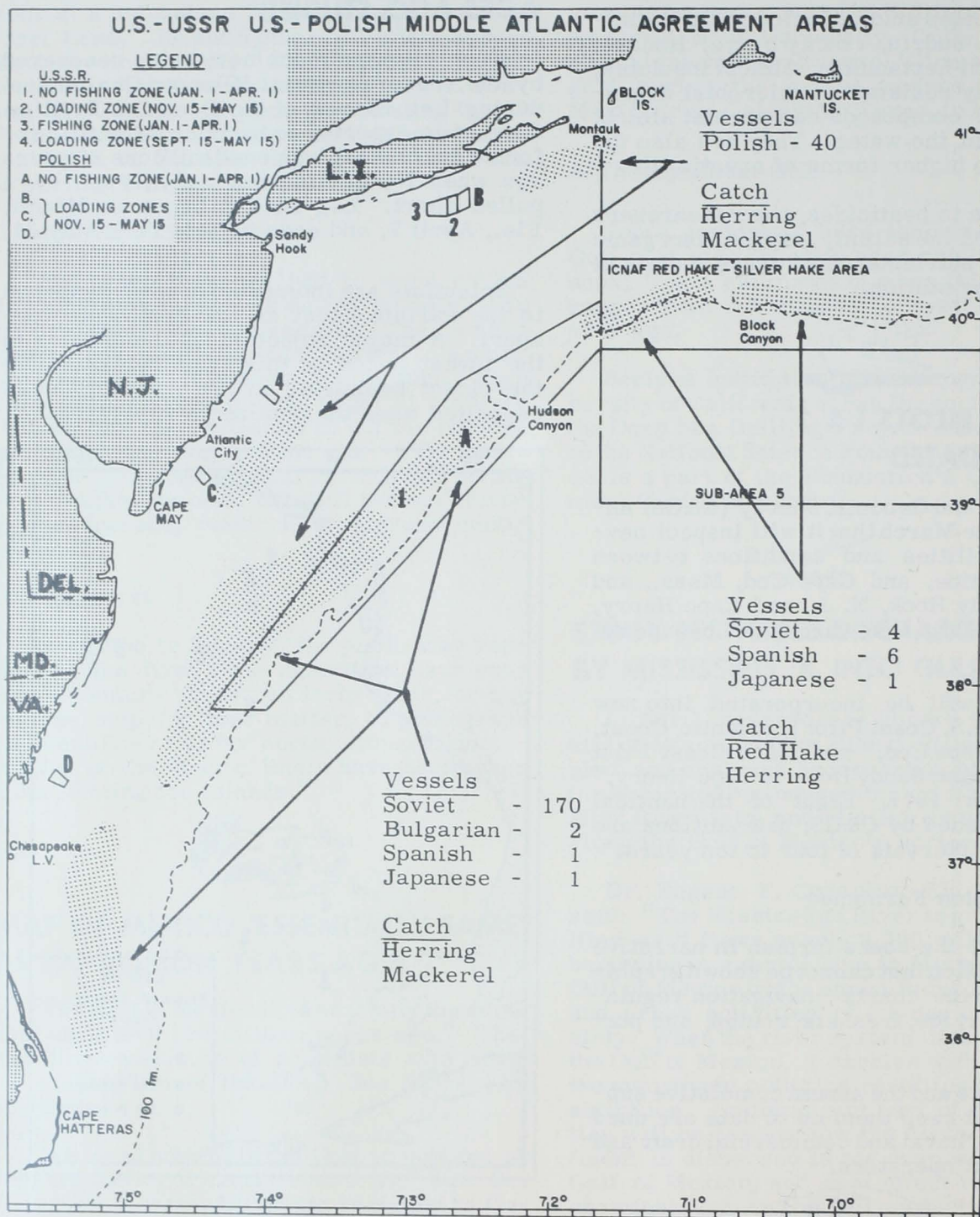


Fig. 1 - Foreign-flag vessels fishing off southern New England and Georges Bank, Mar. 1970 (shows no. of vessels and species fished).

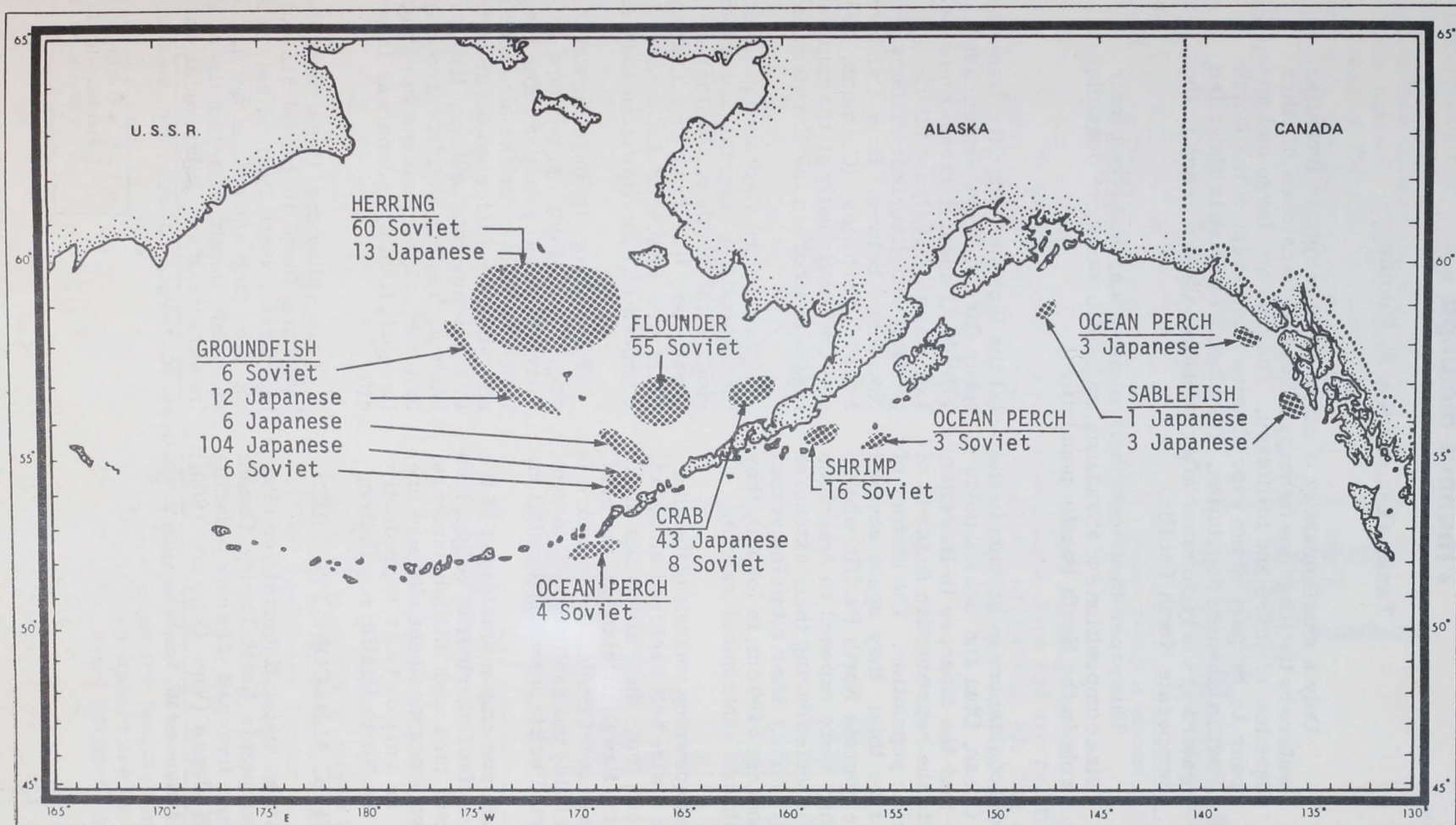


Fig. 2 - Foreign fisheries off Alaska, March 1970.