Fishermen guide dungeness crab pot (60-inch diameter) being lowered by boom to power barge. See Article p. 44.
(Robert M. Meyer)

HUMPHREY PROPOSES NATIONS DEVELOP LEGAL PRINCIPLES FOR OCEAN-FLOOR ACTIVITY

Vice President Humphrey has proposed that the nations of the world seek early agreement on legal principles to guide their activities in exploring and using the deep-ocean floor. His proposal was read on June 24 at the opening of the Third Conference of the Law of the Sea Institute of the University of Rhode Island at Kingston, R. I.

The Vice President is Chairman of the National Council on Marine Resources and Engineering Development, better known as the Marine Sciences Council.

He noted that a United Nations ad hoc Committee is considering such legal principles. The U. S. view is that an internationally accepted, precise boundary of the deep-ocean floor be outlined as soon as feasible. It should take into account the Geneva Convention on the Continental Shelf. This boundary can be drawn even before there is international agreement on the general principles applicable to the deep-ocean floor.

What Agreements Should Cover

The Vice President stated that arrangements on exploiting the deep-ocean floor should include provisions for:

"the orderly development of resources of the deep ocean floor in a manner reflecting the interest of the world community in the development of these resources;

conditions conducive to the making of investments necessary for the exploration and exploitation of resources of the deep ocean floor;

dedication as feasible and practicable of a portion of the value of the resources recovered from the deep ocean floor to world or regional community purposes; and

accommodation among the commercial and other uses of the deep ocean floor and marine environment."

Marine Sciences Council

The Marine Sciences Council was set up 2 years ago by the Marine Resources and Engineering Development Act of 1966. The Council is composed of the Vice President, 5 Cabinet members, and 3 heads of other Federal agencies. It advises and assists the President in policy planning and coordination of the marine science programs of 11 Federal agencies.

THE U.S. FISHING INDUSTRY

Seattle Conference Charts Course to Guide Industry Out of Doldrums

A committee representing the 266 participants in "The Conference on the Future of the United States Fishing Industry," held in Seattle, Wash., March 25-27, has issued a conference report that puts first things first.

The report states: "The major conclusion to be drawn from the Conference is that the principal immediate problems are in the domestic fishery. Processing, retailing and distributing sections are in general doing well primarily because of the increasing population of consumers. Their primary problem is expansion to obtain a larger share of the rapidly growing food market."

The Conference was sponsored by the University of Washington College of Fisheries, BCF, the National Council on Marine Resources and Engineering Development, and private industry.

The report discusses the causes of stagnation in the fishing industry, outlines industry's probable development in the years ahead, and recommends ways to develop a stronger industry.

It recommends 4 major changes that "can do much to rectify the existing situation":

- Government policy should be shifted "from the predominate emphasis on the protective aspects of conservation to a positive policy of developing fisheries and an economically healthy seafood industry."

- The seafood industry as a whole should recognize that "its future depends upon a healthy, domestic fishery which can profitably harvest the underutilized stocks of fish off the U. S. coast."

- Sections of the seafood industry should develop "a more unified viewpoint" in their relationship with public and Government.

- The fish industry should identify itself more closely as a part of the food industry.

THE DOLDRUMS

Before the conference convened, Dr. Richard Van Cleve, Dean of the College of Fisheries, explained the "stagnation" of the U. S. fishing industry. He said:

"By 1966 the annual total world production of fish had increased from about 40 billion pounds in 1948 to more than 115 billion pounds. The U. S. fishing industry, however, did not keep pace with this growth, and over the last 30 years production of fish in the U. S. has remained almost constant at between 4 and 5 billion pounds per year.

"This has been particularly surprising, since the consumption of fish and fish products in the U. S. has been expanding at about the same rate as world production. By 1966 annual consumption had grown to 12.4 billion pounds, an increase of about 9 percent a year since 1958."

This gap between U. S. fish production and consumption was so wide, Dr. Van Cleve noted, that in 1966 the U. S. imported over 65 percent of the fish and fish products used.

THE FISHING INDUSTRY

The many-faceted fishing industry harvests fish on all U. S. sea coasts and the larger fresh waters and sells its catch throughout the U. S. It uses many methods to harvest dozen of fish species and makes many products. The problems of Maine fishermen differ from the California fishermen's. And, in many ways, the fishermen's problems differ from those of processors or distributors.

While conference participants differed in the emphasis they put on industry problems, "there was general agreement on the need for an economically healthy fishing industry which would contribute substantially to the domestic economy."

The U. S. fisherman cannot meet profitably the domestic demand for many seafood

products. So the processing and distribution sections of the industry depend more on imported raw materials and finished seafood products. Of course, this hurts the fisherman. The committee report strikes a warning: The supply of some foreign-caught fish will be reduced greatly in the future as demand for this fish increases abroad. "This could be economically disastrous for the processors and retailers who have become dependent on imported fish."

There is irony in the U. S. situation. The U. S. has large stocks of fish off her coasts, her fishermen can operate any kind of equipment anywhere in the world, and she is the world's largest market for fish products.

The report answers 2 very important questions: Why do so many fishermen fail to make money? Why in the past 30 years has the U. S. shifted from producing practically all of her fish to importing over two-thirds?

Many U. S. fishermen are caught in a squeeze: the prices they receive are held down by other protein foods and by imported fish--but their production costs are rising. "Not only are many U. S. producers in trouble, but their problems are expected to become worse unless strong remedial measures are taken."

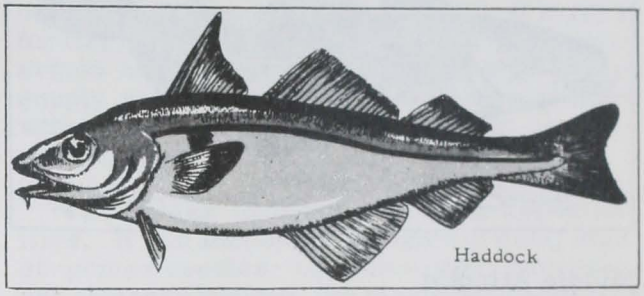
MAJOR CAUSES OF FISHERMAN'S PLIGHT

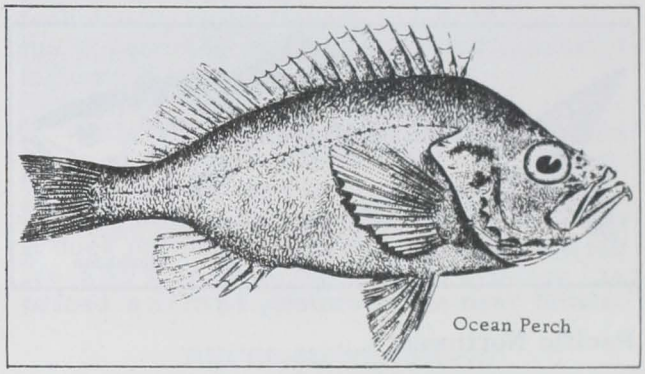
The report sets forth 3 major causes of the fisherman's plight:

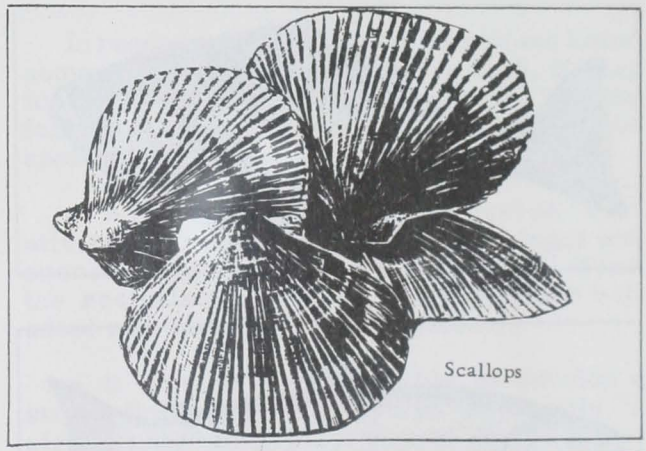
- There are too many boats and fishermen in the traditional fisheries--and the catch has leveled off. These fisheries attracted fishermen and investors when catches were rising, but when the harvest limit was reached the fisheries became unprofitable. "When government has stepped in to save the resource it usually has regulated the fishermen to make them less efficient."

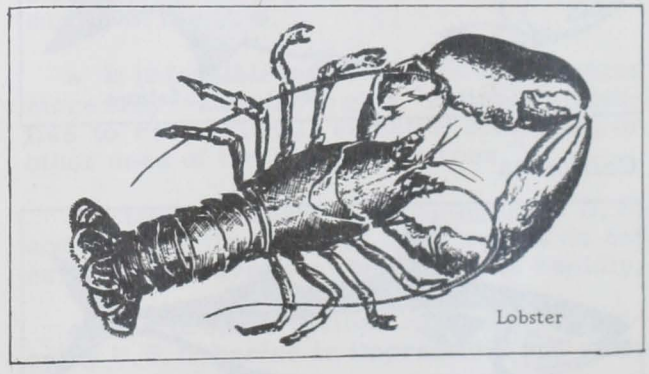
"Most of our well-known natural stocks of fish are near the sustainable limit of production." The list includes in --

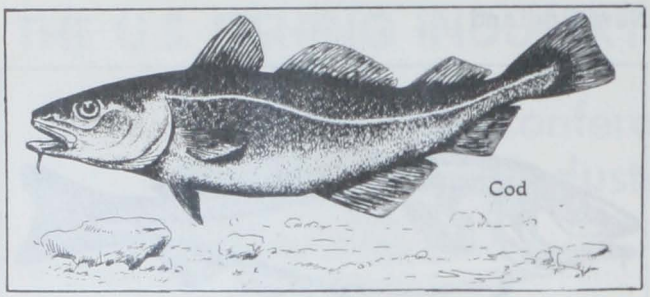
New England


Haddock

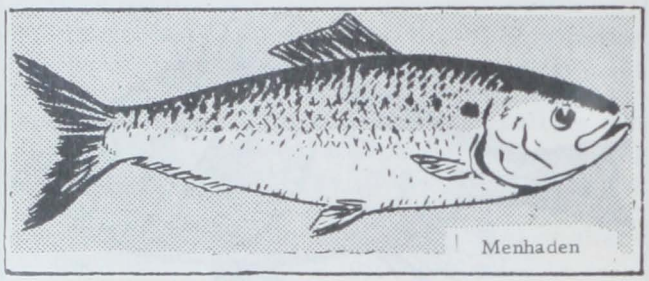

Ocean Perch


Scallops

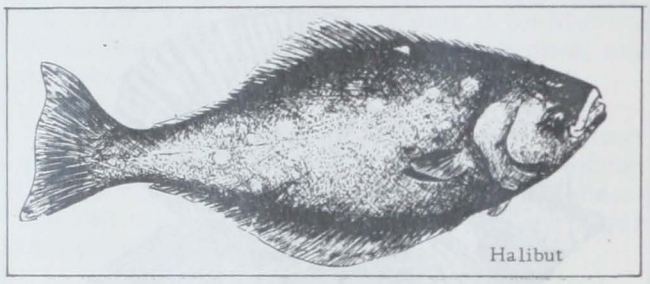

Lobster

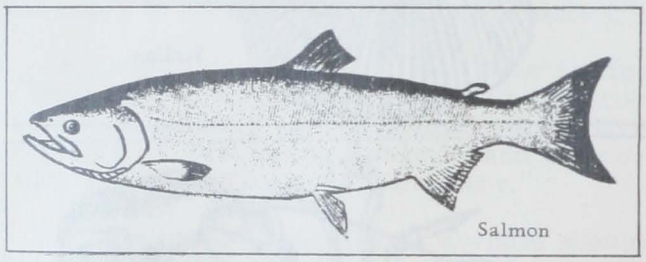


Middle Atlantic

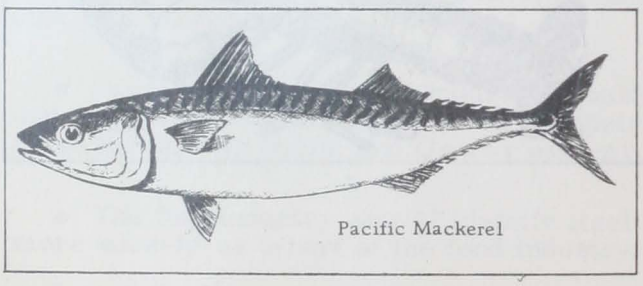


Pacific Northwest





California



"Few, if any, of these stocks will yield more sustainable catch no matter how hard they are fished."

In all these fisheries, there is "too little return on capital invested and too many fishermen making too little money." A solution to this problem will come when the fisherman and the investor are rewarded as much as labor and the investor in the U. S. economy as a whole. This cannot be achieved "as long as everyone who chooses is permitted to enter these fisheries."

- Many State and Federal restrictions prevent development of new fisheries--for example, of Alaska herring, California anchovy, and Gulf of Mexico threadfin herring.

- Confusion is produced by the separate jurisdiction of States and the "lack of effective coordination" of management or investigation across State lines. Added to this is the 12-mile fisheries limit recently claimed by the U. S., which creates a limbo of authority or action between the 3-mile territorial limit and the 12-mile limit.

FUTURE HOLDS SOME PROMISE

Despite the many problems of the fishing industry, the report states that the "future is promising for using underutilized species." U. S. fishermen could increase their catch off U. S. coasts at least tenfold. They can do it more economically than a foreign fleet that has to come thousands of miles. At present, because the public does not know most of these stocks, the fishes have no "market identity."

Most of these stocks are not in the areas of the traditional stocks. They "require different fishing gear, different handling methods, and different processing methods." But all these stocks are nutritionally equal to the traditional species and many are comparable in taste appeal. If these stocks were fished, they could supply the rapidly growing market for high-quality protein foods.

"The largest marketing opportunities in terms of volume are in the production of fish meal, fish protein concentrate (FPC), and frozen fish blocks."

There are large, growing U. S. markets for fish meal and frozen blocks, now dependent largely on imports, and both can be made

Fig. 1 - Fish meal.

Fig. 2 - FPC.

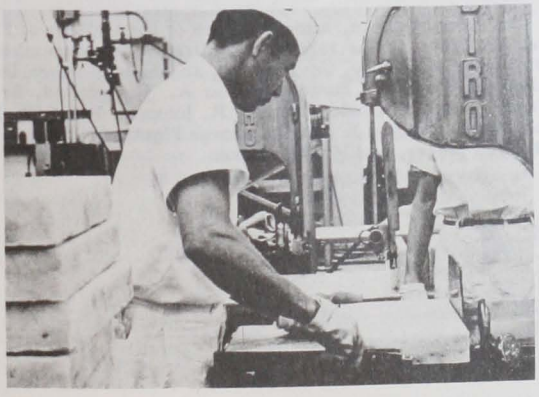


Fig. 3 - Frozen fish blocks.

from many species. FPC "is expected to offer a major market in the near future." The pet food industry offers another large market for fish. The report emphasizes: "Our fishermen can reach these markets only if they supply raw materials at a price competitive with that of other suppliers of plant and animal protein."

The fishing industry has other opportunities. It can increase the catch of many higher-prices species: certain crabs, mollusks, and northern shrimp. By modifing processing techniques, more fishery products can enter the burgeoning convenience-food market at higher retail prices.

While the Seattle conference did not consider aquaculture at length, the report states: "It offers many opportunities for the production and sale of high-priced fishery products. It does not seem to offer a significant promise anywhere in the U. S. to produce low-priced animal protein in the near future."

RECOMMENDATIONS

In recommending the 4 major actions listed above to correct problems in the U. S. fishing industry, the committee emphasized that the following "precepts and principles" must be applied:

- A large part of the fishing fleet is "relatively efficient within the existing legal and economic restraints on the fisheries." When the restraints are lifted, the fishermen will adopt new methods and equipment.

- It is technically feasible to develop a strong fishing industry that can supply "a significantly larger portion of the fish consumed in the U. S."

- It is feasible to use the sea's resources more fully--and also to give "suitable priorities to recreational, esthetic, scientific, or other uses of the living resources."

- Effective ways of managing most U. S. and foreign fisheries in U. S. waters do not exist. The ways must be developed rapidly.

- The present divided authority in managing U. S. fisheries is impractical and must be corrected.

- Fishery regulations should be designed to encourage rather than discourage fishing efficiency.

• The industry's continuing deterioration or greater dependence on imports is not in the best interests of the U. S.

Based on the above fundamentals, the report recommends to all concerned:

• Consider jointly, because they are interdependent, development of the ocean's potential to help solve world food shortages and development of a strong U. S. industry. Government should help.

• Areas of authority in managing resources must be defined better. This would permit effective use of scientific management knowledge--and development of research to investigate condition of fish and shellfish stocks.

• Consider the "limited entry concept of management . . .to improve efficiency of harvesting living resources with adequate safeguards to avoid monopoly."

• Government at all levels should eliminate restrictions based on cutting the fisherman's efficiency.

• Remove unwarranted restrictions on marketing fishery products: for example, the requirement that FPC be marketed in 1-pound packages. The U. S. must strengthen its policy on the rational use of living resources of the high seas.

• Government aid must be directed mainly toward encouraging use of underutilized stocks--and evolution of effective fishing and processing systems for existing fisheries.

• Government should identify and then help when production of existing fisheries can be raised by developmental work. One example is hatchery production of coho salmon a sound economic basis by Columbia River hatcheries.

• Government, industry, and universities should develop data to permit evaluation of the fishing industry's status. One study should compare costs from producer to consumer in the U. S. and abroad.

• Industry should develop and expand the market for seafood items by insuring high quality "through quality control of raw material, production, and distribution by the industry." Government inspection systems should be designed. The fishing industry should operate as part of the food industry and so benefit from the latter's marketing and sales-promotion techniques.

Committee Offers Some New Ideas

In summary, the committee states that its recommendations differ from most made previously. They stress the need for a more postive U. S. policy toward developing the fishing industry; encourage improvement of efficiency in fishing fully utilized stocks; emphasize the development of underutilized stocks; suggest change in Government responsibility for managing fisheries; propose industry action to improve its position in the U. S. food market.

If industry, universities, and Government carry out these proposals, the committee states, the seafood industry would be able to react to opportunities to develop resources off U. S. coasts, adopt technological innovations, and make itself strong.

The report concludes: "Major problems confronting our industry can be resolved by a cooperative approach of industry, the academic community, and government, but their resolution will depend strongly on government policy and attitude towards domestic fisheries."

Dr. Donald Bevan, associate dean of the College of Fisheries, was chairman of the report committee. Other members representing the University, Government, and industry were: Dayton L. Alverson, Rovert L. Burguer, James A. Crutchfield, Brewster Denny, John B. Glude, Donald R. Johnson, Ralph W. Johnson, John Liston, Marion E. Marts, George Pigott, William F. Royce, Sigfryed Jaeger, and Harold Lokken.

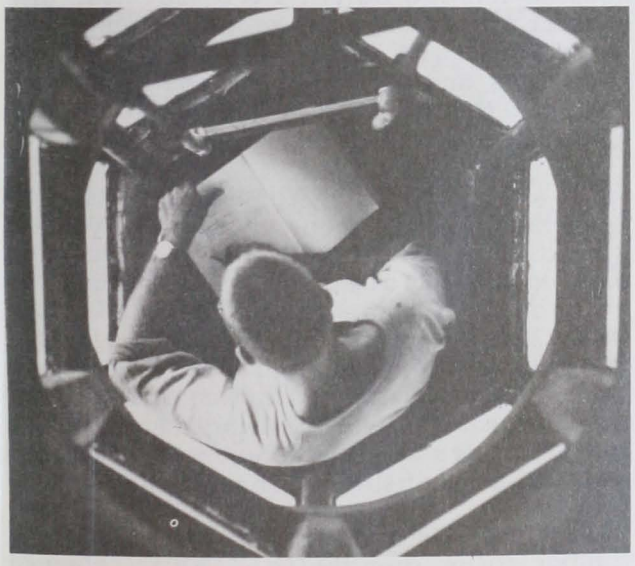
UNITED STATES

Ford Foundation Aids Science of Ecology

The Ford Foundation has granted $3,964,550 to 7 universities to advance the science of ecology. Ecology deals with the interrelations of living things with each other and with their common environment. Today there is a shortage of ecologists and the foundation's action seeks to improve the situation.

The 7 universities are Yale, Johns Hopkins, the University of Washington, British Columbia, Missouri Botanical Gardens (affiliated with Washington University), University of California, Davis Campus, and Colorado State University.

In 1967, the foundation gave the University of Chicago $1,036,000 and Princeton $372,000 to expand programs in ecology. Five of the 7 new grants are for the same purpose.



Vehicle to study ocean's upper layers. Biologist Reginald Gooding in observation chamber of raft "Nenue" of BCF's Biological Laboratory in Honolulu.

Gooding designed and built it to study fishes that accumulate under floating objects at sea. View chamber extends 7 ft. under water. In cramped quarters, biologists view and photograph many creatures. (Photo: J. J. Magnuson)

Avoid Unplanned Exploitation

The chief of the foundation's natural resources and environment program, Gordon Harrison, made clear that the organization did not seek to stop or even slow mankind's exploitation of environments. It did want to help man exploit wisely--and so avoid the disastrous results of unplanned exploitation.

Harrison said industry creates civilizations, but industrial exploitation has polluted man's environment. He noted that inorganic fertilizers increase crop yields--but deplete the soil. And new fishing techniques greatly increase the catch--but encourage overfishing. This, Harrison added, threatens the survival of food fishes on which people and large industries depend.

Population Boom

To these problems, Harrison emphasized, add the population explosion.

"The precipitous increase in human population has begun all over the world to put unprecedented demands on natural resources to feed and clothe the multiplying generations, to absorb wastes of industrial and life processes, and to provide living environments conducive to human well-being," he said.

"Some of the first consequences of these population pressures are already critical and highly visible--inadequate food supply in the less developed nations, pollution in developed areas."

Governments apply technological remedies that work for a time. But they can have "consequences in the longer run that precipitate other crises, unless ecology and related sciences produce the solutions."

Fishery Rights and the Law of the Sea

A Summary of Our Fishing Rights and Obligations on the High Seas

By John Radovich*

The appearance of the Soviet fishing fleet off California's coast in 1967 has aroused the emotions of at least a portion of California's commercial and recreational fishermen. Some are saying, "We told you they were coming," and others were asking, "Why doesn't the U.S. Navy or Coast Guard or someone chase them away? What right do they have off our coast, exploiting our stocks of fish and competing with our fishermen?"

The answer is, "They have a legal right to fish off California's coast provided they fish at least 12 miles offshore."

Under international law, the high seas are not subject to the jurisdiction of individual countries. They are free for the use of all. However, there are rules and procedures by which fish may be protected from over-exploitation.

Up to 1958, a body of international law of the sea had developed through the common practice of nations, the unilateral proclamations of some and the bilateral or multilateral treaties among others. In an effort to codify existing law into treaty form, resolve existing issues, and establish some international system for protecting and conserving the living resources of the sea, the United Nations sponsored a Law of the Sea conference in Geneva, Switzerland, in 1958.

There were 86 nations present at this conference, and they hammered out four different conventions, or agreements, which have, to different degrees, gained a measure of stature as international law.

The four conventions were the "Convention on Fishing and Conservation of the Living Resources of the High Seas," the "Convention on the Territorial Sea and the Contiguous Zone," the "Convention on the Continental Shelf," and the "Convention on the High Seas." These four conventions, or agreements, laid the basis for determining the rights and duties of nations on the oceans and in the conservation of the living resources of the sea. To the extent that these conventions codify existing principles of international law, they are, of course, binding on all nations.

Conservation of the Living Resources of the High Seas

The Convention on Fishing and Conservation of the Living Resources of the High Seas was the first to develop an international code for the conservation of fisheries.

This convention provides, among other things, that the coastal state has a special interest in maintaining the productivity of the living resources in any area of the high seas adjacent to its territorial sea. The coastal nation also has the duty to enter into negotiations with nations fishing for these resources and the other nations in turn are obligated to negotiate in order to develop conservation measures.

If, after negotiating for six months, an agreement hasn't been reached, the coastal nation may unilaterally adopt conservation measures to protect and conserve the resources. The measures adopted by the coastal nation cannot discriminate against a distant fishing nation, and must be based on sound scientific findings. For example, the total harvest of a resource could be regulated, but the other country or countries involved still would be entitled to a share in the harvest.

Should these measures be disputed by the fishing nation, then the matter is referred to a special commission of five members for resolution.

The convention further defines conservation as measures resulting in the optimum sustainable yield to secure a maximum supply of food and other marine products.

This convention has not been ratified by the Soviet Union because of its views on the compulsory settlement of disputes as contained in the convention.

*Chief, Marine Resources Branch, California Department of Fish and Game.
Reprinted from "Outdoor California," May/June 1968.

Consequently, the terms of the convention are not binding on the Soviets. However, they have been willing to negotiate fisheries agreements under the substantive terms of the convention.

Convention on the High Seas

The convention on the high seas established four freedoms which had been commonly practiced prior to the convention: freedom of navigation, freedom of fishing, freedom to lay submarine cables and pipelines, and freedom to fly over the high seas. These freedoms apply to both coastal and noncoastal nations.

Convention on the Territorial Sea and the Contiguous Zone

The convention on the territorial sea and the contiguous zone sets out criteria by which nations can measure their territorial seas, sets down rules governing the innocent passage of ships through the territorial sea of a coastal nation, and defines the contiguous zone of a country's territorial sea as extending beyond the territorial sea but not more than 12 miles seaward from the baseline from which the territorial sea is measured.

Within this contiguous zone, the coastal nation may exercise control necessary to prevent infringement of its customs, fiscal, immigration, or sanitary regulations, and may punish infringement of these regulations committed within its territory or territorial sea. The width of the territorial sea was not defined.

The Continental Shelf

The convention on the continental shelf establishes the sovereign right of coastal nations to explore and exploit certain natural resources. The resources involved include mineral and other nonliving resources of the seabed and subsoil, and sedentary living organisms such as crab, which, at the harvestable stage, are unable to move except in physical contact with the seabed. The convention does not apply to the free swimming fishes, nor to the waters, above the continental shelf.

The continental shelf is defined as the seabed adjacent to the coast outside the territorial sea to a depth of 200 meters, or beyond that limit to the extent of the exploitability of natural resources. This brings into focus the need for a rapid expansion and increased competence in ocean engineering, technology, and science, if the United States is to take advantage of the vast resources available to it under the terms of the convention on the continental shelf.

However, since the test of exploitability for expanding the outer boundary of the continental shelf is an objective rather than a subjective one, the technology for developing marine resources of the continental shelf does not necessarily have to be that of the United States. All nations' continental shelves are extended in accordance with the most advanced technology. Prevailing thought is that the deep sea bed may not be subject to this convention.

Territorial Sea and Exclusive Fishing Zone

The Geneva Convention failed to adopt definitions of the territorial sea and an exclusive fishing zone in 1958. A second Geneva Convention was held in 1960 where one proposal of many failed by one vote of having the necessary $\frac{2}{3}$ vote for passage. This measure, proposed by the United States and Canada, defined a six-mile territorial sea and another adjacent six miles (total of 12) as an exclusive fishing zone for the coastal nation.

Since 1960, well over half of the coastal nations represented at the Geneva Conventions have established exclusive fishing zones of 12 miles. The United States took this step in 1966, and now has a territorial sea of three miles and an exclusive fishing zone of nine more miles (total of 12 miles).

Because of the general support for the 12-mile contiguous fisheries zone and because of the relative absence of protest from the leading maritime nations of the world to the unilateral acts proclaiming such zones, it is likely that these claims will ripen into international law at some point in the future and will, in the interim, not be held to violate present international law.

However, since some countries are claiming territorial seas or contiguous fishing zones of up to 200 miles, continued difficulties are anticipated between nations until these conflicts are resolved. The United States does not recognize any claim for an exclusive fishing zone beyond 12 miles.

The Russians

The Russian fishing vessels which first appeared off the coast of California in 1966 and have been fishing farther than 12 mil s off our coast have a legal right to do so. And even though the United States has approved

all four conventions and the Russians only three, Russia still has observed the terms of the fourth convention, the conservation of the living resources of the high seas, and has displayed a willingness to negotiate with the United States for the conservation of species under the terms of this convention.

U. S. Food Fish Stocks at Midyear About Same As in Mid-1967

On July 1, total U. S. cold-storage holdings of food fish were about the same as a year earlier. But individual commodities revealed differences.

Stocks of fillets and steaks of every species, except pollock and flounders, were down from July 1, 1967. Total stocks were nearly 8 million pounds lower. Stocks of ocean perch were more nearly normal (last year's holdings were high.)

New England groundfish production was down but imports have kept prices stable.

On the other hand, stocks of fish blocks were up nearly 8 million pounds, and fish sticks and portions up $3\frac{1}{2}$ million pounds. Foreign fish-block producers will need to shift more of their production from fish blocks to packaged fish fillets to keep the prices of the 2 markets in line with each other.

Pacific Halibut

On July 1, total U. S. stocks of Pacific halibut were down $4\frac{1}{2}$ million pounds from a year earlier.

On June 1, Canadian holdings of halibut were up because the 1967 strike there delayed the halibut season. The season is below expectations in landings and prices.

Because U. S. stocks were down and the season will close this fall with lower-than-expected catch, higher halibut prices will be needed to ration the available Canadian and U. S. stocks through the winter until the new season starts in May 1969.

Low Sockeye Run

This is the second year in a row that the major run of red, or sockeye, salmon in Alaska is very low. The rest of the salmon season needs to be watched closely this summer to determine quickly the price level necessary to move the new canned salmon pack evenly through June 1969. By September, nearly all the pack will be in.

Shellfish

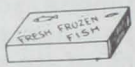
Shellfish stocks were down more than 3 million pounds from a year earlier. Every shellfish item except raw shrimp was down. The drop in breaded and other forms of shrimp was enough to bring total stocks of shrimp down slightly.

A normal shrimp-production season in the Southern States is expected this year.

Scallops

Scallop production on the Atlantic coast was low for both Canadian and U. S. fishermen--and prices were high.

The new scallop fishery of Alaska must be followed closely to determine its size--and to maintain a price level that will keep consumption in line with available supplies. (BCF Branch of Current Economic Analysis)



Value of Imports Is Up From Year Ago

U. S. imports of edible fishery products during January-May 1968 were worth $241 million--19% above the 1967 period. This was reported in the July 15, 1968, issue of "International Commerce," published by the Bureau of International Commerce.

Imports of meat and meat preparations during January-May 1968 increased 15% over the 1967 period.

Predicts More Imports

The Bureau of International Commerce predicts: "Both meat and fish purchases will be greater than last year. Higher U. S. prices and less vigorous demand in other major importing regions have contributed to the rise in meat arrivals so far in 1968. Imports of fish will reverse their 1967 decline largely because of improved prices and inadequate inventories."

Pacific Halibut Landings Are Below Normal

In 1968, Pacific halibut landings by U. S. and Canadian vessels are expected to be about 58-59 million pounds. The 1968 quota is 58.5 million pounds. In 1965 and 1966, landings surpassed the quota by 4-5 percent; in 1967, landings were 7 percent short of the quota.

In 1968, only about 27-28 million pounds will be caught by U. S. vessels. By May 31, the U. S. share was only 41 percent of total landings. Last year, fishing for Pacific halibut was hampered by a prolonged Canadian fleet strike and lower prices. No strike seems in the offing, but halibut prices continue low.

By July 1, landings were higher than a year ago but lower than preceding normal years. However, inventory is lower and consumption higher. The fishing effort of the U. S. and Canadian halibut fleets might be affected if the present low-price trend continues.

Fish Meal From TVA Shad & Carp Used in Broiler Growth Study

Fish meals made from shad and carp taken from lakes of the Tennessee Valley Authority (TVA) are equal to menhaden fish meal for broiler growth and feed efficiency. This was reported by University of Tennessee scientists. They also stated that carp fish meal is equal to menhaden fish meal in chick pigmentation properties.

The scientists conducted a 4-week growth study to determine the effects of several levels of fish meals prepared from TVA shad and carp on broiler growth, feed efficiency, and xanthophyll (natural yellow) pigmentation. They used 480 broiler-type cockerel chicks.

The Study

Each fish meal was added to the diet to supply fish protein equivalent to that supplied by 2, 4, 6, 8, and 16 percent of a high-quality menhaden meal. A diet containing no fish meal was fed as a negative control.

Results

The average body weight and feed efficiency of the chicks did not differ significantly between treatments. Skin pigmentation generally increased as fish-meal level in the diet increased. At the 2, 4, and 6-percent supplementation level, chicks fed diets containing shad fish meal were lighter in color than those fed diets with carp and menhaden fish meals. No evidence of thiamine deficiency was noted in any chicks. ("Feedstuffs," June 22.)

Shrimp Supply Rose 15.6% in 1967

The available U. S. shrimp supply in 1967 was 15.6% higher than in 1966 and 20.1% above 1965. Shrimp imports again set a record in 1967. They increased 4% above 1966 and 13.3% above 1965.

Lake Superior Sea Lampreys 86% Less Than In 5 Years Before Controls

The catch of adult lampreys at the 16 electrical barriers on U. S. streams tributary to Lake Superior was 7,936 this year. The catch was much above the level during the past 2 years--but below the average for all years since chemical control affected the lampreys.

In 1968, the lamprey population is 85% below the 5-year average before controls were used.

Panamanian Fishermen Grateful for BCF Gift of Haul Seine

Members of a fishermen's cooperative in the village of Montijo, Panama, short of nets, have received a farm-pond haul seine from BCF. They are grateful for it. The fishermen expect the gift to increase their catches up to 40 percent, according to newspaper reports. Many undernourished families in Veragus Province also will benefit.

The seine was released to the Peace Corps by BCF's Branch of Exploratory Fishing at Kelso, Arkansas.

Japanese Survey U. S. Household Use of Canned Tuna in Brine

The Japan External Trade Organization (JETRO) recently conducted a household survey in the U. S. to determine consumer response to canned tuna in brine. A total of 370 householders in Boston, New York, and Philadelphia were asked how many times a week they ate canned tuna. An average of 3 percent said it now uses canned tuna twice a week compared with once a week 2 years ago. The frequency of consumption rose more among the relatively heavy users.

Why They Eat It In Brine

Among householders eating canned tuna in brine, those who use more now than 2 years ago exceeded those who reported using less now. Reasons for increased consumption were: "for diet," "taste," "children's preference," etc. Among the lighter users a relatively high percentage said its consumption dropped because children's preference had changed.

The study of frequency of consumer shift between in-oil tuna and in-brine tuna revealed 38 percent switched frequently from one type to the other. Many of them switched because they "wanted to change," and a fairly large number was motivated by price.

52% Chooses Quality

Among users of Japanese canned tuna in brine, 52 percent said its choice was based on quality, and 9 percent said price. Users of Japanese brands in the 3 cities averaged 62 percent; this indicated majority of in-brine consumers prefers Japanese pack.

Fifty-one percent of respondents correctly identified Japanese pack, one percent mistook Japanese for a U. S. pack, and 56 percent correctly identified the origin of all brands.

Price A Factor

Thirty-eight percent of respondents said price was an important factor, while 62 percent denied it. In New York, 54 percent of users were motivated by price. The importance of price inducements varied with the city.

Brand Loyalty

Seventy-two percent of brand users said they would stay with brand regardless of price change. In New York, brand loyalty was stronger than in the other 2. Among canned tuna users, a large majority reported it would change brands if price moves 2-5 cents per can; hardly any said they would change for a price difference of less than 2 cents. However, among relatively heavy users, 11 percent said it would change brands even for one cent. This is noteworthy because price change would have greater effect on budget of large families that consume more canned tuna.

How Often Eaten

Among persons interviewed, about 20 percent were regular users of canned tuna in brine, 16 percent were occasional users, and 63 percent were nonusers. Of nonusers, only about 40 percent said they would prefer canned tuna in oil, and 38 percent were not aware of availability of canned tuna in brine. Of the 38 percent, 25 percent did not know such a product existed, and 13 percent has never tried it. ("Katsuo-maguro Tsushin," June 12 & 13.)

Translation of Soviet Fishery Journal

The American Fisheries Society has received an 18-month grant of nearly $25,000 from the National Science Society for a project entitled, "Translation of Journal, Problems of Ichthyology (1968 Volume)." The Society will translate, edit, print, promote, and distribute the 1968 volume of "Voprosy Ikhtiologii" (Problems of Ichthyology), a publication of the Academy of Sciences of the USSR.

The English-language edition will run to more than 800 pages per volume. The translation of the first 1968 issue of the journal was slated to be completed and distributed in July 1968. Subscriptions can be ordered for $48 per volume from the American Fisheries Society, 1040 Washington Bldg., Washington, D. C. 20005.

)CEANOGRAPHY

:ientists Hope to Solve Mystery f Deep Scattering Layer

One of the great mysteries of the ocean--eep scattering layers--has turned scientists f the U. S. Naval Oceanographic Office into etectives. These seagoing sleuths recently etted their "evidence," thousands of marine rganisms, on a 7-day cruise north of Hawaii. he task is to analyze the evidence in the lab-ratory hoping that it will shed some light on he composition of the deep scattering layers.

The marine life caught on the Pacific cruise, the first of its kind undertaken in the Pacific by the Office, will be compared with specimens collected since July 1965 on simi-lar operations in the Atlantic. This should help the scientists develop a worldwide view of the deep scattering layers, which were discovered by accident during World War II.

What Scattering Layers Are

Deep scattering layers are horizontal, sound-scattering, bands that exist at various depths, generally in the upper 3,000 feet, over broad reaches of the world's oceans. The bands often produce "false bottoms" on the recording traces of echo-sounding devices. Cartographers have charted nonexistent shoals because their sound equipment traced deep scattering layers instead of the actual sea bottom.

Scientists have learned that marine animals making up the deep scattering layers migrate to the surface at sunset and descend to mid-depths at sunrise. Now oceanographers must determine the types of marine life inhabiting the deep scattering layers. Although they believe the most important organisms in the layers are fish possessing swim bladders, which act as air bubbles to scatter sound waves, they have identified only a few. Fish known to inhabit the deep scattering layers are lantern fish, hatchet fish, and bristlemouths.

Fish Swim Bladder

A fish swim bladder is an excellent scatterer of sound energy. The frequency of the sound it scatters best, its resonant frequency, will vary--depending on the depth and diameter of the bubble. A small bubble has a higher frequency than a large one. Scientists know that the swim bladder expands and contracts as the fish migrate up and down the water column, but they do not fully understand its mechanisms.

Problems

The high mortality rate of the delicate animals has made the job of analyzing the gases contained in the swim bladders, and determining the oxygen needs of the fish, extremely difficult. The very act of catching the organisms, in nets lowered to as much as 360 fathoms, shocked the animals. They were either injured or killed as they thrashed against each other and against the nets. Rapid temperature change from the depth of capture to the surface also may have caused many organisms to die before landing.

Equipment

Thirty-six different collections or catches, with a 10-foot Isaacs-Kidd midwater trawl and a 6-foot Tucker net, were made during a 4-day stay at the study site, 240 miles north of Oahu. Biologists will identify the organisms and try to determine the depth at which they were caught--their vertical distribution in the water column. Catches with the Tucker net, which opens and closes at predetermined depths, will help the biologists determine vertical distribution. The Isaacs-Kidd trawl, an open net, caught marine life at all levels. A 4-chambered sampler, which can be electrically triggered to close at any depth to collect 4 separate samples, will be used on future trips.

Acoustic Measurement

At present, acoustic measurement of the layers is made with a "bomb" or a 2-pound charge of TNT, detonated at a predetermined depth by a pressure-activated device. Though "bombs" provide valuable information on sound scattering, they are not suitable for measuring individual layers. Experiments are being conducted with a pulse sounding system--a directional, downward-looking instrument similar to the echo-sounder used to chart the ocean floor. This system should permit detailed measurements of individual layers at several different frequencies. Both methods were used on the Pacific cruise, but the pulse system still needs development.

The "bombs" gave more valid information. Measurement techniques are continually improving, and the scientist hope they will be able to chart the layers--for the Navy and the marine community.

Gulf Stream Meanders Probed

Six oceanographers of the U.S. Naval Oceanographic Office are trying to answer a question this summer that puzzles ocean scientists: "Why does the Gulf Stream suddenly begin to wander aimlessly along its northern edge after flowing from Florida to Cape Cod on a fairly straight, well-defined path?" These meanders are deviations of the current's flow pattern.

During a combined ship-aircraft operation, the oceanographers are studying the structure and rate of change in the meanders along the Gulf Stream's northern boundary. The primary phenomena being investigated are "the volume of water transported by the meanders, the distribution of heat in the study area and the horizontal or vertical flow of sea water as it deviates from its flow pattern."

The Area

The scientists selected a 55,000-square-mile area about 200 miles south of Halifax, Nova Scotia. This area is broad enough to cover several branches of the meandering Gulf Stream. It was chosen because it is well east of Mt. Kelvin, the largest underwater mountain in the chain off New England.

The oceanographers reached their destination July 20 aboard the USNS "Lynch." An aircraft carrying other scientists was scheduled to make 6 flights over the area starting July 29.

The Lynch oceanographers have divided their 5-week operation into 2 phases as their ship travels east-west path over the area.

The Operations

Every 10 miles along the east-west course, they drop expendable bathythermographs. These are instruments used to detect and record the water's temperature distribution pattern in relation to depth. The bathythermographs are "expendable" because the scientists do not have to recover them to get the data. The instruments are catapulted over the ship's side and are connected by wire to recorders aboard the vessel. These recorders make a temperature trace as each bathythermograph sinks.

At stations on the survey area's borders the scientists are using new instruments called STDs to obtain data to compute the relative current velocities and the volume of water coming through the area. They also are collecting temperature and salinity data with 13 Nansen bottles wired for different depths and lowered on one string to the ocean floor. Continuous surface measurements of salinity and temperature are being obtained.

Second Phase

Phase II of the operation was scheduled to begin August 9. Essentially it will repeat the bathythermograph tests of the first phase. The second readings compared with the first may give the scientists an idea of any changes in the course of the meanders.

The Lynch oceanographers hope to obtain preliminary analyses of data at sea. However, most of the data, and the information gathered by the airborne oceanographers, will be sent back for coordination at the Oceanographic Office.

Airborne Scientists

Concurrently, the airborne scientists will be flying over the same area on a north-south pattern. They will drop expendable bathythermographs at 45-mile intervals between the ship's lanes. Installed in airborne canisters, the bathythermographs will transmit temperature readings in relation to the depths by radio to the airborne scientists. The readings will be put on magnetic tape and fed to Oceanographic Office computers which can either store the information or make graphic plots of the data.

The airborne scientists will make a surface-temperature survey and search for large "fields" of phytoplankton blooms--the visible evidence of great concentrations of microscopic marine plants. Because pilots on previous flights over the Gulf Stream noticed these "fields," a marine biologist is aboard the Lynch to find out what nutrients are causing the enormous phytoplankton growth and to collect samples of the organisms.

)ceanographers Study Histo / f N. Atlantic Ocean's Floor

Scientists aboard a modern oceanographic hip, the USNS "Kane," are trying to unravel e history of the North Atlantic ocean floor. he operation is part of Project GOFAR of e U.S. Naval Oceanographic Office to seek obal understanding of ocean-floor geologi- al processes and their relationship. This nderstanding could enhance the Navy's erational capability and increase knowl- ge of the ocean floor and its natural re- urces.

lid-Atlantic Ridge

The Kane departed in late June. In early uly, she was gathering data on a major nderwater fracture zone in the Mid-Atlantic idge, created when the ridge crest was isplaced laterally.

During the 2-month cruise over the frac- ure zone, the oceanographers are studying its magnetic signature, echo soundings, seismic reflection and seismic refraction. hey are dredging at daily station stops over he underwater cliff formed by the earth's reaking movement. They hope the dredging may enable them to collect rock uncovered y the fracture. "Other station work includes iston coring, sea floor photography, temper- ature and salinity probes, heat flow investi- gations, and studies of the amount of sediment eing carried in the water near the bottom."

All magnetic and topographic data are eing fed into computers aboard the Kane, hich are compiling profiles of the ocean loor.

The oceanographers are working up the data as they go and hope to have a good analy- sis of the cruise when it ends.

Off Northwest Africa

When the mission along the fracture zone is completed, the scientists will cruise for about a month off Africa's northwest coast before returning home along the path of a different, southern fracture zone. They plan to study the nature of the African continental rise, which is wider than the rise off the U.S. east coast.

Scientists know that an underwater current, acting as a submarine river, has deposited sediment along the continental rise off the east North American coast. The scientists aboard the Kane want to see if the situation is the same on the African side.

National Academies to Study U. S. Part in Ocean Exploration

The National Council on Marine Resources and Engineering Development (Marine Resources Council) has contracted for the National Academy of Sciences - National Academy of Engineering to carry out an initial study of the scientific and engineering aspects of U.S. participation in the International Decade of Ocean Exploration. The final report is scheduled to be submitted by April 1, 1969.

Vice President Humphrey, Council Chairman, said: "Since President Johnson proposed, last March 8, an International Decade of Ocean Exploration for the 1970's, both national and international response to this great concept has been most favorable. Now we are turning to the Academies to assist the Council in developing the U.S. contribution to the Decade and in identifying scientific and engineering goals, objectives, milestones, priorities, and timing."

Study's Other Purposes

The study will include the "identification of capabilities required to achieve these goals in terms of manpower, marine data, instrumentation, sea and shore facilities, and funds. . . . identify the end products that should be produced during the Decade such as charts, maps, research reports, and atlases. . . . be concerned with benefits to be expected in terms of advancements in science and engineering and in the Nation's capabilities to use the seas more effectively."

Scripps Finds Its 'Fish'

A $50,000, electronic, seafloor-mapping instrument lost in November 1967 on the ocean floor in nearly two miles of water when its towing cable broke has been located and recovered. It is working again for the Scripps Institution of Oceanography, University of California, San Diego.

The instrument is called FISH by the researchers of Scripps' Marine Physical Laboratory (MPL) who developed it. The 4-foot, 1,500-pound FISH carries 5 different sonar systems, plus photographic equipment and magnetometer. All are designed to provide information about the fine scale nature of the deep-sea floor.

Day FISH Sank

Dr. Fred N. Spiess, Scripps associate director and MPL's director, was aboard the "Thomas Washington" Nov. 19, 1967, when she was towing FISH during seafloor mapping 30 miles south of the tip of Baja California. About 13,000 feet of coaxial cable weighing 10,000 pounds was attached to FISH as it sank.

Dr. Spiess said several factors helped him and his colleagues locate FISH when they returned to the area recently aboard the Washington for additional bottom studies: the exact acoustic navigational data being obtained when the cable broke, the information recorded aboard ship from the sonars and magnetometer, and a duplicate FISH.

Dr. Spiess added: "We know of very few instances in which a piece of oceanographic gear has been lost at the bottom of the ocean and later recovered. But thanks to the mapping done by the lost FISH and the scanning of its sister, previously built as a spare, we again have both of the instruments available."

Lifting FISH

A Scripps-developed device brought the lost FISH to the Washington's deck. It was a device pulled across the ocean floor that grasped a cable between two plates held together by powerful springs. It was lowered and towed across the area where the map indicated FISH and its cable must be.

On the third crossing, the scientists noted an abrupt increase in the output of the cable strain gauge. This indicated they had hooked on to the submerged cable.

After 9 hours of maneuvering the ship and operating the winch that was lifting the FISH and the cable attached to it, the instrument was raised to the deck. Alongside the new FISH, it was returned to San Diego.

Found In Good Shape

Except for 2 non-anodized aluminum plates badly corroded, the lost FISH was in near-perfect condition even after 6 months on the ocean floor. The FISH was covered by a special epoxy paint applied by the Navy Electronics Laboratory Center in San Diego.

"We looked over the instrument, saw it to be in remarkably good shape, and are ready to use it on our next deep-tow ocean runs on the East Pacific Rise next January," Dr. Spiess said.

Coast Guard to Experiment With Buoy-Satellite System

The National Data Buoy Project of the U. S. Coast Guard will conduct a satellite communications experiment this fall from an ocean data buoy in the North Pacific Ocean. The communications equipment will be installed in the Office of Naval Research buoy "Alpha," which will be put in place later this year as part of the joint Coast Guard-Office of Naval Research-Scripps Institution of Oceanography "North Pacific Experiment."

Data will be transmitted from the buoy located about 1,500 miles north of Hawaii, to a receiving station at San Diego, Calif., via the NASA ATS-1 satellite.

The Program

The test is part of the Coast Guard program to develop systems of unmanned ocean data buoys that will measure and report continuously and automatically, important environmental information from remote ocean areas. This program was undertaken by the Coast Guard under the direction of the National Council for Marine Resources and Engineering Development. Ultimately, it will provide detailed weather and ocean information. The test results are expected to compare directly data telemetered by 2 types of radio transmission--single-sideband radio and a synchronous satellite relay.

The Coast Guard says this is the first instance of satellite-relayed information from an unmanned buoy moored in the deep ocean. The test program also will provide background information and experience in design and maintenance of satellite communications equipment capable of unmanned, long-term, operation in an ocean data buoy.

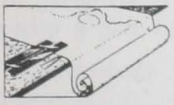
Tidal Current Charts for Upper Chesapeake Bay Available

The Coast and Geodetic Survey has published the first tidal current charts showing the speed and direction of the tidal current in Upper Chesapeake Bay. The new data appear on a set of 12 charts. The charts cover the bay from the Patuxent River to the Chesapeake and Delaware Canal.

Each chart, 11 by 19 inches, provides a comprehensive view of the hourly speed and direction of the current throughout the 95 miles of the bay's upper half. It is a means of determining quickly for any time the speed and direction of the current at numerous places in the bay.

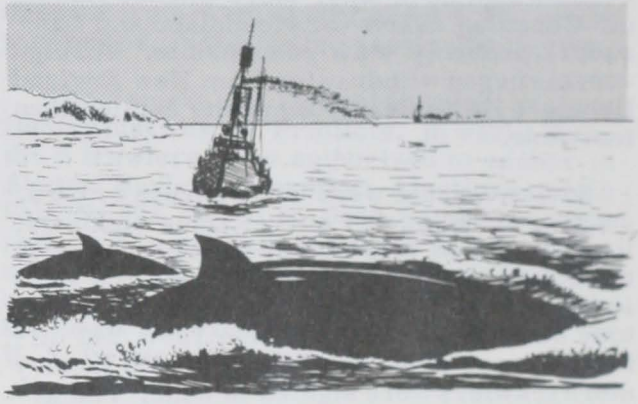
The new charts are useful to commercial shippers, boaters, and fishermen.

Copies may be purchased from the Coast and Geodetic Survey (C44), Rockville, Md., 20852, or from its sales agents, for $1 per set of 12 charts.



Navy Scientists Eavesdrop on Whale "Talk"

Probably never before have whales been pursued by men seeking only to listen in on their conversation. But in mid-August, scientists of the U. S. Naval Oceanographic Office and the University of Rhode Island sailed aboard the university's 180-foot research vessel, "Trident," into the North Atlantic for just that purpose.



They hope to track down and record sounds produced by several species of whales that inhabit the Newfoundland and Nova Scotia area. The scientists are using a variety of sophisticated acoustical devices.

Whale "Talk"

Sonar echoes from whales and those from submarines are similar. Whale "talk" has been known to create problems for the Navy's anti-submarine forces. The scientists are attempting to study the strength of echoes that result from bouncing sound off the mammals' bodies, record whale "talk," and correlate the behavior of whales with the sounds they make.

Foreign Fishing Off U.S. in June

IN NORTHWEST ATLANTIC

The persistent fog and haze that engulfed New England's offshore and coastal regions during much of June reduced aerial observations and prevented complete assessment of foreign fishing. About 125 vessels from the Soviet Union, East and West Germany, Poland, and Cuba fished in the Northwest Atlantic off the U. S. coast--about half the estimated 250 vessels sighted in May. More intense fishing off Canadian coasts (Newfoundland and Labrador) probably was responsible. Foreign vessels began withdrawing from New England fishing areas nearly 2 months earlier than last year.

Soviet vessels were most numerous. Judging from weekly surveillance sightings, it is estimated the Soviet fleet averaged 75 to 100 vessels; 103 different vessels were identified as 100 medium trawlers and 3 factory base ships. (During June 1967, 243 different vessels had been sighted.) No factory stern trawlers were sighted in June. The average 25 sighted stern trawlers per month during 1968 has been smaller than in earlier years, when 75 stern trawlers were not uncommon during the peak season. As in 1967, most of the Soviet stern trawlers were to the north, off Canada.

Eight West German, 1 East German, and 2 Cuban stern trawlers were also sighted.

Several Polish vessels were reported fishing off New England in June.

Soviet: Throughout June, the fleet was divided into groups generally dispersed along 30-fathom edge from south of Block Island, R. I., to southwest slopes of Georges Bank. The largest concentration was 20 to 30 miles south, midway between Block Island and Martha's Vineyard. Moderate catches on board were primarily herring and some mackerel. Smaller groups of vessels south of Nantucket Island and along eastern slopes of Georges Bank were taking herring, whiting, and some red hake.

West German: During scheduled Coast Guard patrol, June 18 to 21, 8 vessels (2 stern trawlers and 6 side trawlers) were located fishing along Northern Edge of Georges Bank--for herring at 40 fathoms.

Two side trawlers (estimated 160 feet) engaged in pair trawling were fishing about 100 yards apart. They were joined by their towing lines and a line running from one vessel's bow to the other's, held taut while vessels were towing (probably to maintain fixed distance). One tow lasted about 5 hours and produced meager catch of estimated 15,000 pounds of herring. The other 6 vessels were working as single trawlers.

This is the first evidence in 1968 of W. German side trawlers off U. S. east coast. During August-October 1967, at least 6 freezer stern trawlers fished herring on Georges Bank, east of Cape Cod and southern New England.

East German: It is assumed that 1 stern trawler was exploring on northern Georges Bank. Five freezer stern trawlers fished herring along Northern Edge of Georges Bank during August 1967, and 2 vessels remained off U. S. until early November.

Cuba: The stern trawler "Biajaiba" was sighted on June 19 fishing among Soviet fleet about 25 miles south of Martha's Vineyard off Massachusetts. A small quantity of fish on deck appeared to be herring.

Greek: The trawler "Paros" (1,500 gross tons) came to Boston on June 28 for supplies. She began fishing off east coast about June 1 and was not very successful. Only about 100 metric tons of herring, mackerel, squid, and cod were on board, frozen in blocks. Cod was principal target, but when not available other species were sought. If fishing continued poor, Greeks were expected to leave ICNAF area.

Japanese: No vessels were sighted. The Japanese Fisheries Agency "licensed" 3 stern trawlers to operate in area.

OFF MID-ATLANTIC

No reports or sightings of foreign vessels off mid-Atlantic in June.

The 2 Japanese stern trawlers reported there in May were not sighted. None of the additional vessels expected to "explore" have appeared.

IN GULF OF MEXICO AND OFF SOUTH ATLANTIC

No vessels sighted fishing off U. S. Atlantic coast south of Cape Hatteras (including Florida) or off U. S. Gulf of Mexico coast.

OFF CALIFORNIA

Soviet: Six stern factory trawlers were sighted, 5 for first time this year off California. Vessels previously fishing departed.

Vessels were observed only during one week; remaining 3 weeks no Soviet fishing off California. All vessels were fishing when sighted June 13. One was 18 miles off Point Reyes, and 5 were 20-22 miles west of Klamath River mouth. Although the latter were close to shrimp beds, the catches were black cod, hake, and other bottomfish. Mesh size in cod end of net was $3\frac{1}{2}$-4 inches.

OFF ALASKA

Soviet vessels increased, Japanese effort decreased, and first South Korean independent factory trawler arrived.

Soviet: About 25 vessels were fishing off Alaska, about 15 more than at end of May 1968, only about two-thirds number sighted off Alaska in June 1967. As in June 1967, most activity was centered along Aleutians.

Nearly all effort in Soviet perch fishery was along Aleutians particularly on Stalemate Bank west of Attu Island. About 10 medium trawlers and 3 processing vessels arrived there in early June and fished through month.

As in 1967, no vessels in Gulf of Alaska fished for ocean perch during first-half June. About mid-month, one medium trawler and one stern trawler began exploring along 100-fathom curve in western Gulf. By month's end, only the medium trawler remained.

The trawl fishery for pollock, flatfish, perch, and gray cod off Continental Shelf edge in eastern and central Bering Sea declined from 9 medium trawlers in late May to about 5 in early June. This small fleet continued fishing through month and was located north of Fox Islands in eastern Aleutians at end of June.

The N. Pacific whaling fleets apparently remained in western and central N. Pacific, as in 1967, because more appeared off Alaska during June.

The fur-seal research vessel "Krylatka" was sighted about 60 miles west of Attu Island in early June.

South Korean: Early in June, the processing vessel "Sam-Sui 301" and her 6 pair trawlers were joined by a refrigerated fish-carrier "Sam-Su 201." By late June, an independent stern trawler of about 1,500 gross tons had begun fishing in eastern Bering Sea.

The Sam-Su 301 fleet spent most of June fishing just west of Pribilofs. In early June, the 6 trawlers were authorized to anchor in Akutan Harbor in eastern Aleutians, while Sam-Su 301 sailed to Sand Point to pick up new radio equipment. Many trawler crew members went ashore on Akutan Island. As a result of this unlawful entry into the U. S., the South Koreans were fined $10,000 by the U. S. Immigration Service.

The refrigerated transport vessel Sam-Su 201 entered Dutch Harbor near the end of June to purchase water. It was boarded by a BCF Resource Management Agent. The vessel was scheduled to return to South Korea July 1 with 4,000 metric tons of refrigerated whole salted Alaska pollock. The Sam-Su 301 and her trawlers reportedly were to return to Korea by the end of July.

An independent stern trawler off Alaska was sighted in late June on Bristol Bay "flats" northwest of Port Heiden, presumably fishing for flatfish and Alaska pollock.

Japanese: As in 1967, the vessels off Alaska decreased from over 300 in early June to about 250 in late June. The declines were caused primarily by dispersal of high-seas salmon fleets from south of Aleutians toward western North Pacific.

The transfer of 4 small stern trawlers from eastern Bering Sea, and arrival of large stern trawlers, increased Japanese effort in Gulf-of-Alaska ocean perch fishery from 4 trawlers in early June to 10 or 11 by mid-June. During second-half June, as in latter half of May, the Gulf effort declined as some trawlers moved south to British Columbia and others returned to Japan. Only about 3 trawlers remained at month's end.

The effort in the Japanese ocean perch fishery along Aleutians increased from a few vessels in late May to about 10 in early June. However, by month's end, only about 5 trawlers remained. Several vessels that fished along Aleutians during first-half June were trawlers working their way west along Aleutians to Japan.

Trawlers fishing for ocean perch along Continental Shelf edge in eastern and central Bering Sea varied from 5 to 8 vessels in June. Some vessels moved to Aleutians, then sailed home. They were replaced by others arriving from Japan.

The trawl fishery for Alaska pollock and flatfish to produce minced meat and fish meal was continued by 5 factoryship fleets in eastern and central Bering Sea. The fleets remained scattered on Continental Shelf from outer Bristol Bay to well northwest of Pribilofs.

The 2 crab factoryship fleets that moved from Continental Shelf of outer Bristol Bay to Pribilofs in May returned to outer Bristol Bay in June. A similar pattern was followed by the 2 fleets in 1967. Also, at least 3 other vessels engaged in pot crab fishing in eastern Bering, northwest of Pribilofs, in June. One vessel, a larger side trawler, served as processing vessel (presumably freezing) for at least 2 smaller vessels setting and retrieving pot gear. A similar fishery was conducted during summer 1967.

The long-line fishery for sablefish in Gulf of Alaska was continued by 2 vessels during first-half June. About midmonth, one vessel returned home and was followed later by the other.

In second-half May, up to 12 trawlers and 3 gill-net vessels fished for herring between Pribilofs and Togiak Bay in northern Bristol Bay. By June 1, the trawlers had quit and, shortly thereafter, the 3 gill-netters moved north into Norton Sound. A BCF agent boarded one trawler and was advised that trawling for herring had not been very successful. The trawlers were not able to fish their gear at midwater to near-surface levels to successfully take herring.

The high-seas salmon fishery, which began in late May, remained centered well southwest of western Aleutians through first week of June. Most fleets then began dispersing westward in North Pacific and Bering Sea. Only 3 fleets worked eastward during June--one fished south of Aleutians to near 180th meridian; then, by late June, it returned to southwest of western Aleutians. The other two moved northeast into Bering and fished along 180th meridian 200 to 300 miles north of Aleutians. Japanese sources reported an abundance of Asian salmon in western North Pacific and Bering Sea made it unnecessary for fleets to move into eastern longitudes, the pattern of previous years.

OFF PACIFIC NORTHWEST

Soviet: During June, 83 different vessels were sighted off Pacific Northwest. The number fluctuated with abundance of fish found off Washington or Oregon. Some weeks, the same vessel would be sighted off both States in same day.

The Soviets now use more stern trawlers than side trawlers in their Pacific Northern fisheries. In last week of June, they had 40 stern factory trawlers off Oregon and Washington--greatest number sighted in one week since they started fishing those waters in 1966.

The fleet found hake abundant off Washington and Oregon during June except for last week. Good to excellent catches, primarily of hake, were observed taken by both stern and side trawlers. As much as 40,000-50,000 pounds were taken in one observed haul. During June, there were 5 Soviet research vessels off Pacific Northwest.

Japanese: In June, only 3 stern trawlers were sighted off Pacific Northwest--2 during first week and third appeared later. No fish were seen on vessels; it is assumed they were searching for Pacific ocean perch.

Aid to Soviet Fishermen: The U. S. Coast Guard reported 2 Soviet fishermen from stern trawlers were evacuated to the hospital at Newport, Oregon.

Soviet Violations: On June 12, the U. S. Coast Guard (USCG) patrol from Port Angeles (Wash.) sighted the medium side trawler "Kamenii" fishing at 44°52' N. and 124°29' W., thereby violating the U.S.-USSR Agreement on North Pacific Fisheries. The agreement specifies that vessels under 110 feet "shall not engage in trawl fishing in areas of high concentrations of ocean perch." The patrol plane then dropped a message advising captain of violation and requesting him to leave. The Soviet Fleet Commander was also notified. Kamenii belongs to Kamchatka Fisheries Administration; her home port is Petropavlovsk-Kamchtskii.

Soviet violations again occurred on June 17, when a USCG patrol plane sighted 8 Soviet vessels where the USSR had agreed not to fish. Vessels were identified as 8 stern factory freezer trawlers. USCG plane dropped a block message warning Soviets of violation but received no positive response. Seattle USCG District Command then sent a cutter. When the cutter arrived, all Soviet vessels had left.

AN EVENING TO REMEMBER

Entertaining? Your elegant dinner can be an evening to remember if you open the first act with a colorful scene stealer, Tuna Cranberry Cocktail. Tuna, always a featured player in sandwiches, salads, and casseroles, attains star billing in this first course recipe. Tuna Cranberry Cocktail is refreshing, unusual, and has a secret--it's easy to do.

A popular adventurer from the briny deep, tuna joins forces with orange sections for tang and ruby-red cranberries for zest. Topped with a zippy whipped cream-horseradish dollop--this eye arresting and taste attesting cocktail adds a lift to the dinner that will intrigue your guests and be the highlight of the dinner-table conversation. The perfect first course--light, lovely, and luscious.

Tuna Cranberry Cocktail

1 can ($6\frac{1}{2}$ or 7 ounces) tuna
1 cup orange sections
$\frac{3}{4}$ cup whole cranberry sauce
$\frac{1}{4}$ cup whipping cream
1 teaspoon horseradish
Salad greens

Drain tuna. Break tuna into large pieces. Cut orange sections into bite-size pieces. Combine oranges and tuna. Whip the cream. Blend in horseradish. Arrange salad greens in sherbet glasses. Place about $\frac{1}{4}$ cup of tuna mixture in each glass. Place cranberry sauce over tuna mixture. Top each cocktail with whipped cream. Makes 6 servings.

STATES

Alaska

SCALLOP VESSEL
MAKES GOOD CATCH

After 8 days of fishing off Yakutat, the 90-foot New England scallop vessel "Viking Queen" recently landed 47,000 pounds of sea scallop meats in Seward, Alaska. It was one of the best catches reported anywhere in the world. It nearly equaled the total Alaska commercial catch off Kodiak of 50,000 pounds in the preceding 6 months.

The new commercial operation resulted from a combined State, Federal, and private industry project to test the practicability of a commercial scallop fishery in the Gulf of Alaska. The project was based on encouraging catches during explorations by BCF's "John R. Manning."

Production-Style Fishing

The combined project ended during the first week of June. It involved both exploration and simulated production-style fishing by the chartered Viking Queen. It was expected that by July 5 at least 5 more scallop vessels, including 3 New England craft, would be fishing the Alaskan grounds.

* * *

EDA FUNDS HELP
REBUILD CORDOVA DOCK

The Economic Development Administration (EDA) of the U. S. Department of Commerce recently approved a $1,284,000 grant and a $321,000 loan to help rebuild a burned-out dock and save jobs in the fishing community of Cordova, south central Alaska.

The construction of a dock will provide again the main avenue for movement of goods in and out of Cordova. These goods include the salmon pack from 4 local canners, which are the chief employers. The old dock was ruined by a major waterfront fire on April 4, 1968.

The New Dock

The dock is expected to stimulate the areas's economic development. It will serve the Alaska State Ferry System and tug-barge operations. The design plans include provisions to handle roll-on, roll-off cargo. Other facilities will be a concrete municipal dock, a crane to handle containerized cargo, and a storage area. Officials expect the dock to encourage development of a cold-storage facility.

* * *

KUSKOKWIM RIVER
SALMON CONTROVERSY

BCF Juneau reports that early in June Gov. Walter J. Hickel blocked a move by the Kuskokwim Fishermen's Cooperative to sell local salmon to the Japanese. The Governor explained that he was keeping the entire state's interests in mind. If a Japanese freezer ship were permitted to sail up the Kuskokwim to Bethel to receive the salmon catch without primary processing, it would set a precedent opening other ports throughout the state.

Hickel's main concern was that the fishermen's coop at Bethel had signed an agreement with the Japanese without consulting the state. He emphasized: "We cannot have an organization that moves through the international level."

1967 Sales to Japanese

In 1967, because there were no U. S. fish processors available to handle the Kuskokwim catch, the state permitted the sale of salmon to the Japanese. This year, 9 processors assured Hickel they could handle the catch.

However, on June 27, 1968, in a late development, Gov. Hickel issued a news release stating in part: "Because domestic salmon processors at Quinhagak and Bethel have indicated inability to handle record salmon catches at Quinhagak, Gov. Walter J. Hickel has invited the Japanese freezer ship 'Akitsu Maru' to purchase the fish. . . . the invitation to the Japanese is in complete harmony with State policy."

Oregon

FALL CHINOOK SALMON RELEASES COMPLETED

The Oregon Fish Commission completed in July the 1968 fall chinook salmon releases. A record 32 million young salmon were sent on their way to the sea.

About 10.5 million of the small salmon were released into the Willamette River this year. This continued the efforts of the Fish Commission and the U. S. Fish and Wildlife Service to create a fall run with an estimated potential of 100,000 adult fish.

Smaller releases were made into several Oregon streams: 1 million into the North Fork Nehalem River, 450,000 into the Trask, 60,000 into the Sandy, and 45,000 into the Siletz River.

Columbia Gets 20 Million

The Columbia River received the bulk of the fall chinook--20 million. State and Federal hatcheries work to maintain the Columbia's status as the world's largest producer of the valuable chinook species, despite staggering losses of natural habitat.

The biggest share of Columbia River chinook, both hatchery and naturally produced fish, are caught in the ocean sport and commercial fisheries from Alaska to California.

Several years ago, a BCF marking study revealed that Columbia River hatcheries alone contributed nearly 300,000 chinook worth an estimated 2 million dollars to sport and commercial fisheries.

Because fall chinook are caught primarily as 3- and 4-year-old adults, this year's releases will appear in sport and commercial catches in 1970 and 1971.

* * *

SALMON AND STEELHEAD CRISES ON COLUMBIA RIVER

Oregon Fish Commission biologists reported on July 19 that Columbia River salmon and steelhead runs were experiencing serious passage problems in the upper Columbia River.

More than 50 percent of the summer chinook salmon passing over Bonneville Dam up to July 19 had failed to appear on schedule at Ice Harbor Dam on the Snake River, or Priest Rapids Dam on the upper Columbia. On July 18, Fish Commission fisheries technicians counted 40 dead summer chinook salmon below John Day Dam--from the town of Biggs to the mouth of the Deschutes River. (Experience indicates that only few salmon mortalities resulting from such situations can be observed.) It suggested a substantial loss.

Biologists predicted that the "A" segment, or early-arriving summer steelhead run, would be the smallest on record. The Snake River segment of this run, once the dominant one, appeared to be at an extremely critical low level.

Shad Problem Too

Even the omnipresent shad, which recently extended its range far into the Columbia's upper reaches, apparently was experiencing serious difficulties at and below John Day Dam. Thousands were in the fish ladders at the dam, but few were passing into Lake Umatilla. Hundreds of these fish died in the days before July 19 and drifted downstream.

California

SEA OTTER PROGRAM PROPOSED

California's Department of Fish and Game (DFG) has recommended to the legislature a program to lessen the competition between commercial abalone divers and sea otters in the coastal waters off San Luis Obispo County. It seems that sea otters like to eat abalones (marine snails) as much as people do. The program also would accumulate valuable information for preserving the California sea otter--and seek ways of expanding the commercial abalone fishery.

The commercial abalone fishery centers on central and southern California areas and the offshore islands.

The principal species sought are red and pink abalones. Since 1959, the value of landings has ranked between No. 8 and No. 12 among all California fisheries.

The Program: Phase I

The program proposed calls first for trapping, tagging for study, and removing 20 sea otters from the Cambria-Point Estero area.

Other otters would be put in scientific institutions for further study. The remainder would be moved to the state's sea otter refuge north of Lopez Point in Monterey County.

During this 3-year first phase, DFG biologists "would study the animals to determine the effect of transfer, evaluate the breeding success among the affected otters, and begin ecological, environmental and population dynamics studies on the otters."

Phase II

The second phase would be based on information gained during the first phase. It calls for further "ecological, tagging and population studies." Also, sea otters would be removed from abalone-producing areas if this did not endanger the otter population.

Walter T. Shannon, DFG Director, said: "The California sea otter is a rare and unique species, and we have an important responsibility to protect it from the threat of extinction."

* * *

ANCHOVY REDUCTION FISHERY FELL BELOW 10% OF QUOTA

California landings of anchovy taken for reduction purposes were only 6,506 tons when the 1967/68 season closed on May 15. This was reported by the California Department of Fish and Game. Landings were below 10 percent of the 75,000-ton quota for the season that opened Sept. 15, 1967.

Of the 6,506 tons, 5,654 tons were taken in the Northern Permit area, north of Pt. Conception. There, landings early in the season were on an open-ticket basis.

The 1967/68 season catch was down 31,109 tons from 1966/67 and 10,337 from 1965/66. The decline is attributed partly to 5-months-less fishing effort due to price negotiations.

The price for anchovy was set at $16 per ton--$4 below the previous 2 seasons.

* * *

TUNA TAGGED OFF CALIFORNIA CAUGHT NEAR JAPAN

A bluefin tuna tagged off Baja California 4 years ago was caught off Japan's east coast, reports the California Department of Fish and Game.

The tuna was tagged Aug. 13, 1964, near San Martin Island, in a cooperative research program of the California Department and BCF. It was landed 4,736 miles away, on July 4, 1968, after 1,421 days of liberty.

The Tuna

The fish was 2 years old and weighed 29 pounds when tagged; it was 6 and an estimated 171 pounds when captured by a purse seiner off Osaki Zaki.

Bluefin tuna up to 850 pounds have been reported in Japanese waters. The California record for a sport-caught fish is 251 pounds; the commercial record is 297 pounds.

Maine

JUNE 1 CANNED SARDINE STOCKS 200% ABOVE YEAR EARLIER

Canners' stocks of Maine sardines on June 1, 1968, were 231,000 cases greater--over 200 percent--than a year earlier.

Type	Unit	6/1 68	6/1/67	6/1/66	6/1/65
Distributors	actual cases	222,000	193,000	208,000	198,000
Canners	std. cases[1/]	342,000	111,000	248,000	203,000

1/ 100 $3\frac{3}{4}$-oz. cans equal one standard case.

Source: U. S. Department of Commerce, Bureau of the Census, June 1, 1968.

1968 Pack

The 1968 pack, as of June 15, totaled 456,000 standard cases, according to the Maine Sardine Council. This was 212,000 cases more than the 244,000 cases packed in the 1967 period.

Fishing was spotty during late May and early June and limited the canners' pack along the New England coast.

Maryland

MENHADEN KILL IN CHESAPEAKE BAY UNDER STUDY

BCF is cooperating with Maryland in a study of the cause of menhaden mortalities in Chesapeake Bay. The Bureau has made available the services of its Oxford (Md.) laboratory.

During late spring-early summer, the menhaden kill occurs in the Atlantic bays and estuaries. The symptoms include a loss of equilibrium. This culminates in the fish swimming in tight circles at the surface. They are called "spinners."

This year, the kill in Chesapeake Bay started in early June and does not seem as heavy as in previous years. Spinners and dead fish have been seen from below Baltimore harbor to about the mouth of the Patuxent River.

The Spinning Behavior

The spinning behavior is a common distress symptom among fish suffering from a disorder of the central nervous system. The cause of menhaden mortality remains a mystery. Several years ago, at Raritan Bay, N. J., researchers suggested the cause was a gas embolism in the brain, possibly from supersaturation of nitrogen in the water. But, in 1967, an attempt at Johns Hopkins University to duplicate this condition in the lab failed. An attempt also has focused on a possible virus infection. And the Maryland State Health Department examined dead fish and tissue cultures for possible pathogenic bacteria. All these investigations failed to find the cause.

At Oxford Lab

The researchers at BCF's Oxford lab will look for possible pathogenic viruses by using the latest tissue-culture techniques.

* * *

3-YEAR ROCKFISH MIGRATION STUDY NEARS END

Over 5,000 young rockfish (striped bass) were tagged in the upper Chesapeake Bay this year as part of the concluding phase of a 3-year study by University of Maryland scientists into the migration and growth of the fish. The fish is the most important in Chesapeake Bay. The program is financed by Federal and state governments. For the past 2 years, the program has consisted mainly of tagging and recovering very small rock, a size never before tagged successfully.

A small ($\frac{3}{16}$" by $\frac{5}{8}$") green tag is attached to the back or underside of the rock by a thin, stainless-steel wire. A swivel-type arrangement allows the tag to dangle freely. This tag made the research possible.

Recapture Data Valuable

Valuable knowledge about growth, movement, and other aspects of the fish can be gained from recapture information. Project biologists believe it may lead to better use of the species, and to better fishing, as knowledge of movement patterns becomes more definite.

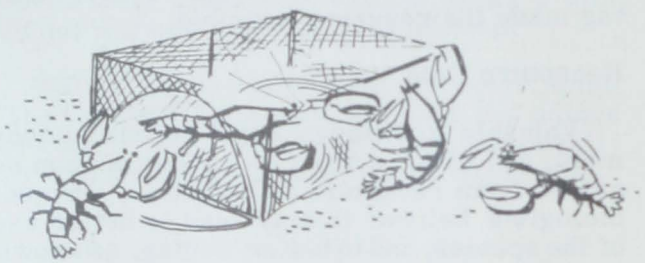
Reward Offered

Dr. Ted S. Y. Koo of the University's Chesapeake Biological Laboratory at Solomons, Md., says that a reward of $1.50 will be given for the return of fish and the tag, and $1 for the tag alone. It is essential that information on date, place, and method of capture be included. Dr. Koo requests all fishermen who land tagged rock to put them in a freezer as soon as possible and contact him either by telephone or letter. The phone number: area code 301, 326-3121.

BUREAU OF COMMERCIAL FISHERIES PROGRAMS

Film Shows Lobster Enters Trap--Then Keeps Out Others

BCF researchers looked at a film strip showing activity around new BCF-designed deep-sea lobster traps and saw something both valuable and disturbing to them and to lobstermen. As soon as one lobster entered a trap and captured the bait, he defended the entrance against any others that sought to enter! More tests are planned to check this finding. If necessary, trap design changes will be made to correct it.



BCF's Gloucester (Mass.) Technological Laboratory and the Exploratory Fishing and Gear Research Base are cooperating in studies of the best methods of trapping these lobsters.

Researchers Transplant Oysters Earlier To Cut Spring Silting Loss

BCF's Milford (Conn.) laboratory is determining whether transplanting oysters in late March and early April is a successful way to prevent the mortalities that occur when oysters begin pumping later in the spring and smother in silt.

This spring, 4 commercial companies transplanted 100,000 bushels of oysters earlier than usual to avoid such mortalities. One area along the edge of a bed in New Haven harbor served as a "control." Here, oysters began dying between March 29 and April 12 and continued to die through May. Total mortality was about 30%.

Earlier Transplant Better Off

The mortality of oysters transplanted earlier from this bed to a bed with no si was less than 2%. Inspections of oysters transplanted early in Norwalk, Conn., also indicated losses under 2%.

Irradiation at Sea Improves Quality of Perch

BCF Seattle, Wash., reports recent tests demonstrated that low-level irradiation of whole Pacific Ocean perch at sea produced "significant improvement in the quality" during the normal period of iced storage.

After 11 days, fish irradiated at 50, 100, or 200 kilorads, either in prerigor or rigor state at sea and iced, were of good quality. Those irradiated ashore 5 and 8 days after catching, though acceptable, were only of fair quality.

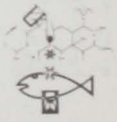
Fair After 15 Days

After 15 days, the fish irradiated either at sea or ashore at 100 kilorads were of fair quality. Those irradiated at the lowest level of 50 kilorads--and the unirradiated fish--were spoiled.

The fish irradiated at 100 kilorad level were acceptable up to 20 days after catching. Therefore, low-level irradiation extended shelf life 4 to 5 days.

First 11 Days Important

The BCF researchers say that the major advantage in irradiating Pacific Ocean perch at sea appears to be improved quality during the first 11 days. During this period, the fresher flavor of fish irradiated at sea "would be more apparent and, therefore, of greatest consumer benefit."



ish Respond More to Speed hanges by Fish on Either Side

Researchers of BCF's Fishery-Oceanography Center at La Jolla, Calif., have analyzed ata on how changes in the speed of Jack ackerel schools are communicated. Their alysis reveals that the latency of a response one fish to another fish's change in speed pends on where it has seen the movement. The velocity of the response depends on the tent to which the other fish increases its eed and the relative angular position of that sh," the researchers report.

ish On Side Greater Stimuli

Fish respond more strongly to speed hanges by fish to left or right of them than those in front or behind. They respond to ll speed changes by all fish in their visual ange--but they adjust their speed more losely to fish on either side.

eographical Differences in When Bluefin School Types Appear

Analysis of logbook data on bluefin schools recorded by U.S. tuna fishermen reveals geographic differences in the occurrence of school types, reports BCF La Jolla. Seventy percent of the 701 breezing schools caught by purse-seine fishermen in 1960-67 were south of 29° N. latitude; 30% were north.

eeding Behavior & Food

The La Jolla scientists suggest that differences in feeding behavior might be responsible for these differences. North of 29° N., anchovies are a major part of the bluefin's diet; south of it, red crab are important. Boiling and jumping of tuna occur when schools feed on anchovies or other small fishes. Breezing, which is the rapid swimming of fish just beneath the surface, "might be associated with filter feeding by bluefin for red crabs."

Barnacle Check Aids Sardine Council

BCF's Biological Laboratory at Boothbay Harbor, Maine, monitors the abundance of barnacle larvae in the water and informs the Maine Sardine Council when and where barnacle larvae are abundant. The lab performs this service because sardines that feed on young barnacles are not suitable for canning and its information permits more efficient use of the resource.

Film on 'Mullet Country' Released

"Mullet Country," a 14-minute, 16-mm. color film that focuses on mullet as a quality food, has been released by BCF. It was produced in cooperation with the Florida Board of Conservation using matching Federal and state funds. Florida is the Nation's No. 1 mullet state.

Mullet Story

The film, the 23rd circulated by BCF, traces the story of the mullet to the Romans, Egyptians, and Polynesians. It includes the biology of the species and demonstrates the 3 major commercial fishing methods. Techniques of processing, cooking, and serving are shown. The film features scenes in St. Augustine, Tarpon Springs, and the Everglades.

'Common Sense Fish Cookery'

BCF has developed a training kit for people working with low-income groups on how to buy, handle, and prepare fishery products.

The kit, titled "Common Sense Fish Cookery," is written in English and Spanish at elementary-school level. It is designed for use as a teaching aid. Together with a film strip now being produced, the kit will help low-income families get the most out of their food money by buying fishery products available in their neighborhoods.

'Delaware' Continues Lobster Explorations With Pot (Trap) Gear

BCF's Delaware returned to Gloucester, Mass., on June 27 after completing the second in a series of northern lobster (Homarus americanus) investigation cruises. (Cruise 68-5, May 24-June 27.)

Cruise 68-5 had 3 parts: 1) grappling for pot gear lost during March-April lobster explorations (Cruise 68-3); 2) continued explorations in Continental Slope area; 3) trapping explorations in shallow water areas within Gulf of Maine and on Georges Bank.

Grappling Gear

The loss of 3 strings (trawls) of lobster traps during the initial offshore trapping cruise demonstrated the need for an effective method to retrieve such lost gear. A special effort was made between the 2 cruises (68-3 and 68-5) to design and assemble equipment suitable and dependable for this purpose. The staff of the Gloucester Exploratory Fishing and Gear Research Base believes the existence of proved grappling equipment will help to minimize gear losses during future operations. It will significantly encourage the developing offshore lobster trapping fishery.

Several improvised grapnels were tried during the latter part of the March-April cruise immediately after the traps were lost. None was successful. The gear for the second cruise was designed to overcome the shortcomings of the first devices.

The new grapnels were made from five 12-foot lengths of $\frac{5}{8}$-inch galvanized steel chain to which steel hooks were attached. The chain sections were spaced along and attached at one end to a 10-fathom length of $\frac{3}{4}$-inch wire rope. Each chain was fitted with 4 single-prong hooks spaced along its length and a terminal 4-prong grapnel. The single-prong hooks were arranged to spiral around the chain and were individually attached to the chain by welds, which traversed 3 successive chain links. All grapnel prongs were made from $\frac{3}{4}$-inch round steel stock.

Grappling Operations

Part I, Cruise 68-5, was spent grappling. The grapnel array was towed with the ends of the $\frac{3}{4}$-inch wire attached to a pair of otter doors; this spread the wire similar to towing an otter-trawl net. The towing speed was kept as slow as possible. During grappling, the resistance of bottom to grapnel was measured by a hydraulically operated tensiometer. When the drag increased beyond the range normal to type of bottom searched, the gear was hauled in to determine what had caused the increased resistance. Debris was hauled aboard before the pots were found.

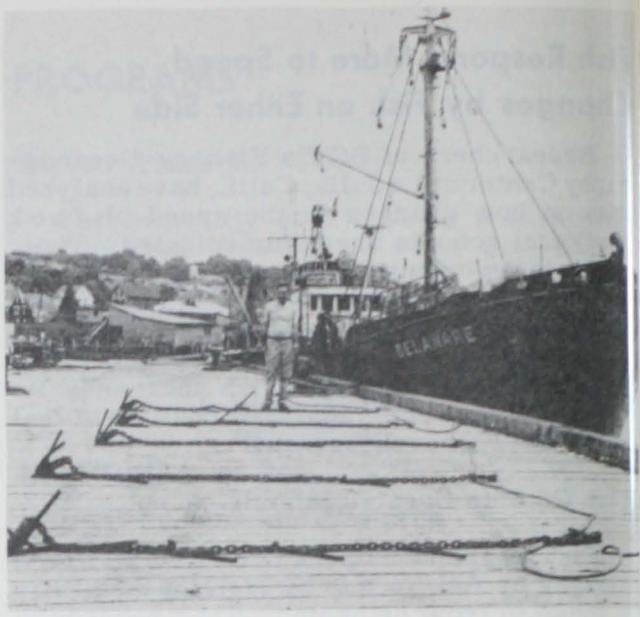


Fig. 1 - The grapnel "array" used to retrieve 19 lobster pots lost in 175 to 210-fathom depths on the Continental Slope.

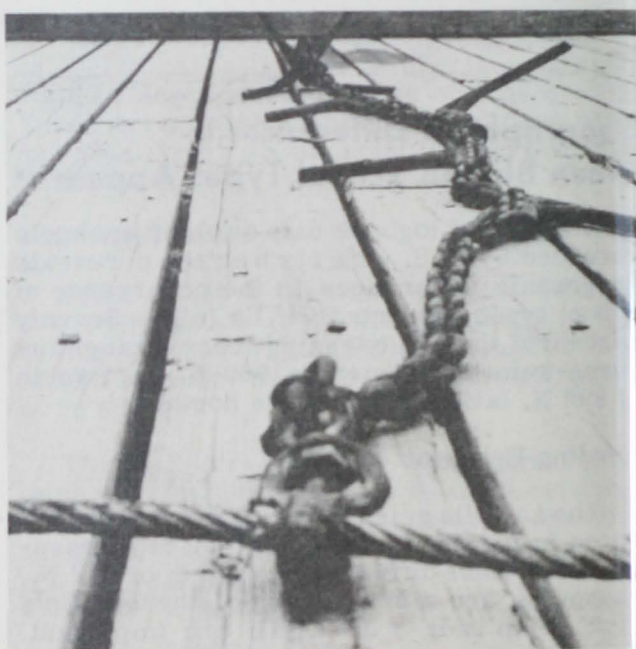
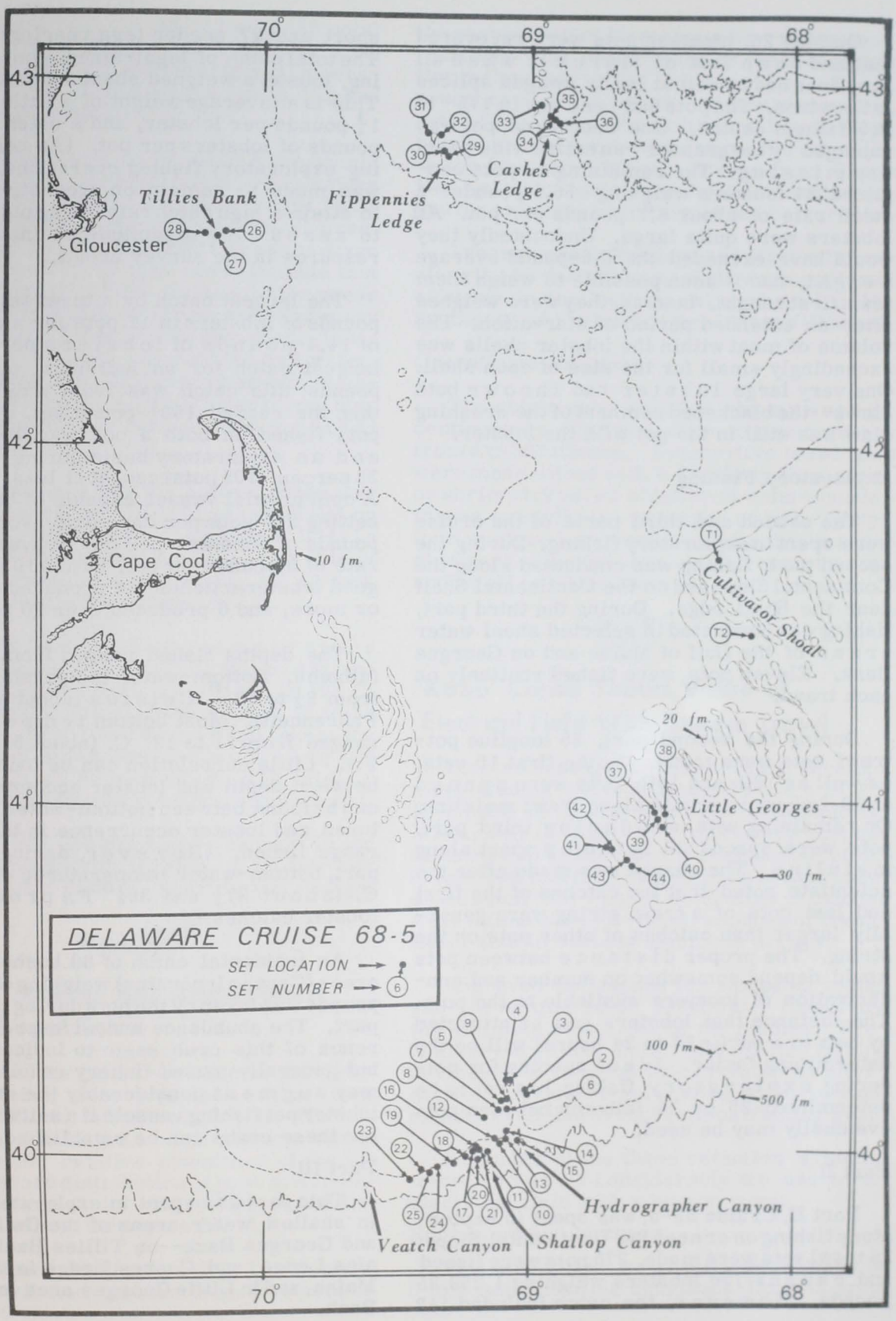


Fig. 2 - Single length of chain on the grapnel "array." The chain snakes over the bottom in close contact with the surface. At least 2 of the single prong hooks, as well as 2 prongs of the terminal 4-prong grapnel, usually maintain bottom contact.


70°
69°
68°
43°
42°
41°
40°
Tillies Bank
Gloucester
Fippennies Ledge
Cashes Ledge
Cape Cod
10 fm.
Cultivator Shoal
T1
T2
20 fm.
Little Georges
30 fm.
100 fm.
500 fm.
Hydrographer Canyon
Veatch Canyon
Shallop Canyon
DELAWARE CRUISE 68-5
SET LOCATION
SET NUMBER
6

On May 26, nineteen pots were recovered that had been lost on March 17 when all buoylines had parted at faulty swaged splices in the wires. The pots had been set in 175- to 210-fathom depths. One recovered pot was damaged by the grapnel--an entire side panel was missing. The remaining 18 pots contained 24 lobsters weighing 156.5 pounds--a catch rate of about 8.7 pounds per pot. All lobsters were quite large. Undoubtedly they would have exceeded the 6.5-pound average weight, had it been possible to weigh them when first caught. Instead, they were weighed after an extended period of starvation. The volume of meat within the lobster shells was exceedingly small for the size of each shell. One very large lobster had thrown both claws--the blackened remnant of the crushing claw was still in the pot with the lobster.

Exploratory Fishing

The second and third parts of the cruise were spent in exploratory fishing. During the second part, fishing was conducted along the Continental Slope and on the Continental Shelf near the Shelf edge. During the third part, fishing was conducted in selected shoal water areas of the Gulf of Maine and on Georges Bank. Eleven pots were fished routinely on each trawl.

During the second part, 25 longline pot-trawl sets were made. On the first 15 sets, as well as 18th and 19th, pots were spaced at 10-fathom intervals along trawl mainline. On remaining sets, and during third part, pots were spaced 20 fathoms apart along mainline. The change was made after the scientists noted that the catches of the first and last pots of a trawl string were generally larger than catches of other pots on the string. The proper distance between pots would depend somewhat on number and concentration of lobsters available to the pots. The distance that lobsters can be attracted by bait to a pot (in 20 to 24 hours) will be the determining factor. Ideal spacing for pots during exploratory fishing has yet to be determined; 25 or 30 fathoms between pots eventually may be used.

Part II

Part II, Cruise 68-5, was spent in exploratory fishing on or near the Continental Slope; 25 trawl sets were made, 275 pots were fished and caught 756 lobsters weighing 1,259.25 pounds. However, the catch included 112 short and 27 seeder (egg bearing) lobsters. The total catch of legal-sized, non-egg bearing, lobsters weighed about 1,068.25 pounds. This is an average weight of a little less than $1\frac{3}{4}$ pounds per lobster, and a catch rate of $2\frac{1}{4}$ pounds of lobsters per pot. (As normal during exploratory fishing operations, no effort was made to remain on productive grounds to attain a high catch rate. The objective was to assess the magnitude and nature of the resource in the survey area.)

The largest catch by a trawl set was $158\frac{1}{2}$ pounds of lobsters in 11 pots for a catch rate of 14.4 pounds of lobsters per pot. The largest catch for an individual pot was $30\frac{1}{2}$ pounds; this catch was from a different set than the record $158\frac{1}{2}$-pound set. Of the 275 pots fished on both a pot gear development and an exploratory basis during this part, 38 percent (105 pots) caught at least 5 pounds. A commercial vessel capable of hauling and setting 200 pots per day could average 1,000 pounds of lobsters per day at average catch rate of 5 pounds per pot. Of the 105 pots with good lobster catches, 46 produced 10 pounds or more, and 6 produced over 20 pounds.

The depths fished ranged from 63 to 162 fathoms. Bottom-water temperature ranged from $9\frac{1}{2}$ to $12\frac{1}{2}^{\circ}$ Celsius (about 49 to $54\frac{1}{2}^{\circ}$ Fahrenheit). Most bottom temperatures ranged from 11 to 12° C. (about $51\frac{3}{4}$ to $53\frac{1}{2}^{\circ}$ F.). Little correlation can be found, as yet, between depth and lobster occurrence; none can be found between bottom-water temperatures and lobster occurrence in the thermal range fished. (However, during the third part, bottom-water temperatures of 3 and 4° C. (about $37\frac{1}{2}$ and $39\frac{1}{4}^{\circ}$ F.) produced no lobster catches.)

An incidental catch of 88 bushels of rock crabs (Cancer irroratus) weighing about 3,520 pounds was taken by the pots during the second part. The abundance and widespread occurrence of this crab seem to indicate a large but generally unused fishery resoruce. This may augment considerably the earnings of lobster pot fishing vessels if a suitable market for these crabs can be established.

Part III

This part was spent in exploratory fishing in shallow water areas of the Gulf of Maine and Georges Bank--on Tillies Bank, Fippennies Ledge, and Cashes Ledge in the Gulf of Maine, and in Little Georges area on Georges Bank.

No lobsters were caught in 3 sets (33 pots) fished on Tillies Bank, or in 4 sets (44 pots) on Fippennies Ledge; bottom-water temperatures were $3\frac{1}{2}$ and 4° Celsius (about $38\frac{1}{4}$ and $39\frac{1}{4}^{\circ}$ F.), respectively.

On Cashes Ledge, 2 lobsters were caught by 22 pots set in bottom-water temperature of $4\frac{1}{2}^{\circ}$ C. and 4 lobsters were caught by 22 pots set in $5\frac{1}{2}^{\circ}$ C. water. As the general direction of water flowing into these areas is from the north, the scientists do not anticipate that future explorations into the deepwater areas of the northern Gulf of Maine will find many areas of heavy lobster concentration. However, limited areas of very shoal water, where mixing with surface water can maintain a somewhat higher temperature, may produce lobster catches of commercial significance.

The temperature of the bottom water was taken in 2 areas near Cultivator Shoal on Georges Bank (northeast from Little Georges area). Near northwest side of Cultivator Shoal, the water was $7\frac{1}{2}^{\circ}$ C. and, near southwest side, it was $10\frac{1}{2}^{\circ}$ C.

On Little Georges Bank, temperature ranged between 9 and 10° C. (about $48\frac{1}{4}$ and 50° F.). Five of 8 sets were made in 10° C. water. Depths fished ranged from 18 to 35 fathoms. Few lobsters were taken; the largest set was 4 lobsters weighing $19\frac{1}{2}$ pounds. From 88 pots fished (8 sets), 9 lobsters weighing $42\frac{1}{2}$ pounds were caught.

Twelve live lobsters were brought in for further photographic studies of lobster reaction to lobster pots of experimental design.

'Rorqual' Studies Brit Abundance Off Northeast Coast

The M/V Rorqual returned to Boothbay Harbor, Maine, after a 2-week cruise from Cape Ann, Mass., to Eastport, Maine. (Cruise 5-68, June 24-July 8.). Its mission was to determine the relative abundance of the inshore-offshore distribution of post-metamorphosed herring--brit--and to sample the environment where they were found.

Preliminary findings disclosed brit were widely distributed inshore from Eastport to the eastern half of Muscongus Bay; there were relatively high concentrations from Machias Bay to the upper half of Penobscot Bay. A less pronounced distribution and abundance was noted from lower Penobscot Bay to Cape Small, except for a very large concentration in the Sheepscot River. Traces from Casco Bay westward were very light and scattered, and the presence of brit could not be verified.

Traces were infrequent and light offshore along the 50-fathom line. Brit were captured offshore in one location only--about 6 miles southeast of Cutler in Grand Manan Channel.

Operational Program

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

'Kaho' Cruise Shows Value of Electrical Field With Bottom Trawl

Electro fishing gear research and development studies were conducted aboard BCF's R/V Kaho in Lake Michigan off Saugatuck, Mich., May 14-June 14. The primary purpose of Cruise 48 was to test and evaluate the effect of an electrical field supplied to a bottom trawl on its catch rate--and to determine if catches were influenced by a visual response of freshwater fish to various electrode arrays.

Improved techniques for sampling young, and harvesting adult, freshwater fishes are the ultimate objectives of the studies. Preliminary work has shown that electro fishing devices hold considerable promise as alternative methods of harvesting species not readily available to conventional fishing gear.

Results of the three retention systems tested favored considerably the use of an electrical field with a bottom trawl.

Equipment and Methods

The electrified trawl tests were made in 6 to 9 fathoms in the Saugatuck-Holland area.

A 41-foot (headrope) Gulf-of-Mexico-type flat trawl was equipped with electrode arrays supplying an electrical field designed to retain fish in a net. The cathodes consisted of lengths of braided, tinned-copper wire tubing, fitted with a smaller diameter braided nylon inner core and a larger diameter braided nylon outer covering. The cathode array consisted of twenty-three 10-foot lengths of electrode material secured to the headrope and foot rope at 2-foot intervals. The anode (postive electrode) array consisted of 3- by 6-foot sheets of bronze screening attached around the body of the net 5 feet behind the cathode.

A commercial, solid-state, direct-current pulsator supplied electrical values through 500 feet of primary electrical cord (10/2) of 10 pulses per second (PPS) at 20 milliseconds duration. Water conductivity at the lake bottom ranged from 210 to 250 microohms per centimeter, and field voltage ranged from 0.6 to 1 volt per inch.

The researchers tested one electrode array design with 3 values of electrode surface area, including: (1) anode and cathode of equal areas, (2) anode area equal to one-half cathode area and (3) anode area double cathode area.

Tests were also made on the visual response of fish to the electrode system. One hundred ninety 10-minute drags were made. Fish were counted and weighed for all drags and length frequencies taken every 5th pair of drags. Water conductivity and field voltage in the net were measured periodically. Scuba divers ascertained electrode array and trawl configuration before testing started.

Results

Efforts were concentrated on retaining fish in a trawl and on visual response of fish to electrode material. Table 1 data indicate a definite visual response of fish to electrode material since more pounds of each species were caught with no electrode arrays in net compared to net with arrays.

Table 1 - Catch Results of Important Fish Species with Electrode Arrays--Versus Results without Electrode Arrays in a 41-Foot (Headrope) Flat Trawl

Species	With Electrode Arrays (12 Drags) Total Pounds	Without Electrode Arrays (12 Drags) Total Pounds	Percent Difference
Alewife . . .	649.5	660.0	3.1
Chubs	207.3	218.3	5.3
Yellow perch	0.2	2.1	950.0
Lake trout . .	3.7	11.5	210.8

Table 2 - Catch Results of Important Fish Species with Electrical Field--Versus Results without Electrical Field in a 41-Foot (Headrope Flat Trawl

Species	With Electrode Arrays (71 Drags) Total Pounds	Without Electrical Field (71 Drags) Total Pounds	Percent Differenc
Alewife . . .	4,190.9	3,173.6	32
Chubs	256.8	145.6	76
Yellow perch.	21.2	3.3	542
Lake trout . .	23.9	14.4	65

Table 2 summarizes fishing results, with and without electrical field, for important species. The results of 142 experimental 10-minute trawl drags (71 with electrical field and 71 without) showed higher overall catch rate for the electric trawl: alewife, 32% increase; chub, 76% increase; yellow perch, 542% increase; and lake trout, 65% increase. Modest amounts of other species were also taken.

Of the 3 retention systems tested, best overall results were obtained with the anode surface area equal to one-half cathode area. This system was also more selective for larger species and more effective for capturing alewife and chub, including young-of-the-year chub.

The Work Ahead

Future work will include testing arrays designed to extend fishing area in front of bottom, near bottom, and midwater trawls. These arrays will use the same commercial electro fishing equipment and have a more powerful freshwater fish-electro-motivator system. The latter being developed in cooperation with the Electrical Engineering Department, University of Michigan.

'Cobb' Explores for Scallops Off Washington

BCF's John N. Cobb returned to Seattle, Wash., on June 14 after a 19-day exploratory scallop fishing cruise off the Washington coast (Cruise 95). The basic objective was to locate and delineate concentrations or "beds" of the weathervane scallop (Patinopecten caurinus).

Secondary objectives were to collect biological data, including information on meat yields, and to determine associated fauna captured by the dredge.

An 8-foot New Bedford scallop dredge with 3-inch rings was used throughout the survey.

Method of Operation

The sampling procedure followed a predetermined grid pattern in which ½-hour hauls were made parallel to the coast at 5-fathom increments from 30 to 60 fathoms. The grid lines were started just south of the Umatilla Lightship and spaced 5 miles apart; the last line occurred off the Columbia River. Whenever an individual haul yielded at least 1 bushel of scallops, additional hauls were made in the immediate area.

The catch from each haul was sorted, counted, and weighed. All scallops were measured; the height[1/] was taken to the nearest millimeter with a Vernier caliper. Samples of scallops were retained and frozen for meat yield analysis by BCF's Technological Laboratory in Seattle.

Results

Seven drags were made along each of 15 grid lines. The speed of tows ranged from 2.8 to 5.6 knots and averaged 4.4 knots.

No scallops were found in the 30-fathom depth interval. Abundance was highest at 50 fathoms, where the average catch was 32 scallops per ½-hour haul. The largest catch (257 scallops) occurred at the 50-fathom station in row 14 off Breakers, Washington. Eight ½-hour hauls made around this station ranged from 0 to 23 scallops and averaged 7 scallops per haul. The second largest catch (140 scallops) occurred at the 45-fathom station, in row 6, off the Raft River. Eight ½-hour hauls made near this station ranged from 17 to 114 scallops; the average was 56 scallops per haul.

Scallops ranged in height from 2 to 5.5 inches and averaged 4.2 inches. Data on size composition and meat yield of scallops taken in the 2 largest catches show:

1/ The distance from the posterior margin of the hinge to the leading edge of the shell in a line perpendicular to the hinge.

Location	Depth (fm.)	No. of Scallops Per Bushel	Average Height (in.)	Average Meat Yield (%)
Breakers, Wash.	50	140	4.3	9.8
Raft River, Wash.	45	195	4.1	8.7

Meat yield data were provided by the Seattle Technological Laboratory.

Incidental Catch

Catches of incidental species were small and similar to those made during scallop surveys off Oregon in 1963 and 1967. A variety of starfish was found. Dungeness crabs were commonly taken in shallow water near the Columbia River.

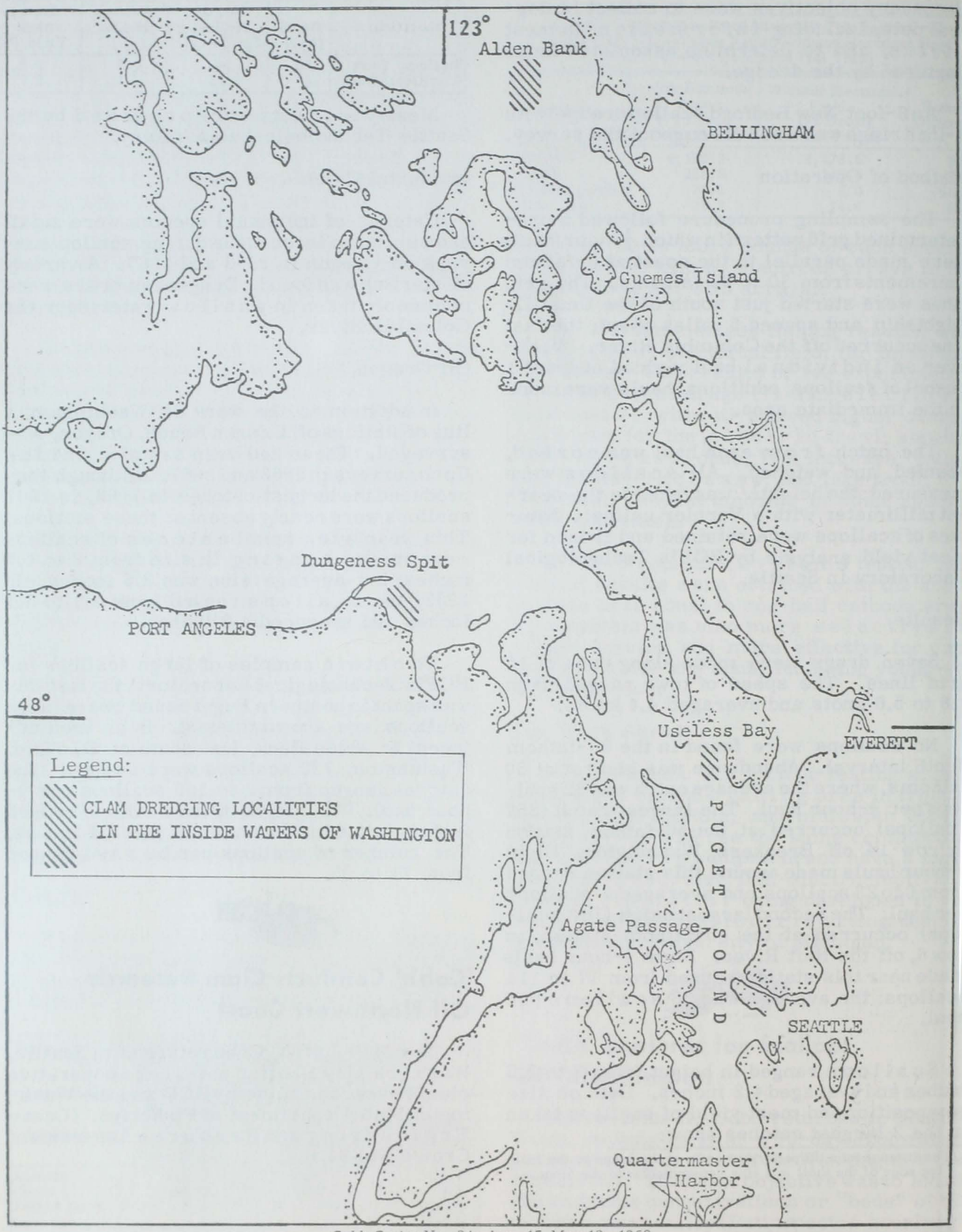
Off Oregon

In addition to the work off Washington, a line of stations off Cannon Beach, Oregon, was surveyed. These had been sampled during Cobb surveys in 1963 and 1967. Although they produced the largest catches in 1963, in 1967 scallops were nearly absent at these stations. This year a few small catches of scallops were made, ranging in size from 3 to 4.5 inches; the average size was 3.6 inches. In 1963, the scallops ranged from 3.1 to 5.1 inches and averaged 4.2 inches.

To obtain samples of large scallops for BCF's Technological Laboratory, the last day was spent in northern Puget Sound where large scallops are known to exist. In an area adjacent to Alden Bank, just south of Blaine, Washington, 732 scallops were taken. The catches ranged from 2 to 160 scallops per ½-hour haul. The height of the scallops ranged from 3 to 6.6 inches and averaged 5.4 inches. The number of scallops per bushel ranged from 71 to 95.

'Cobb' Conducts Clam Research Off Northwest Coast

The M/V John N. Cobb returned to Seattle, Wash., on May 10 after a 4-week cooperative clam research cruise by BCF and the Washington State Department of Fisheries. (Ocean Engineering and Resource Assessment Cruise No. 94.)



Cobb Cruise No. 94, Apr. 15-May 10, 1968.

Primary objectives were to (1) develop clam-dredging techniques for clam surveys in coastal waters of Washington and Oregon, (2) determine effectiveness of a modified hydraulic dredge on littleneck and butter clam beds, and (3) determine availability of clams on Alden Bank, Hale Passage, and northeast of Guemes Island in Puget Sound.

Equipment Used

A modified East Coast-type hydraulic surf clam dredge, borrowed from Washington State, was used. It weighs 1,750 pounds and has a 30-inch wide, fixed-depth, cutting blade. Bottom slats were spaced $1\frac{1}{2}$ inches apart, while side and top slats were spaced 2 to $2\frac{1}{2}$ inches apart. The bag consisted of 2-inch diameter hog rings and 5-inch webbing.

A diesel engine supplying 137 continuous hp. at 1,750 r.p.m. was used to drive a centrifugal pump with 16-inch standard impeller. The pump can supply 1,600 gallons per minute at 112 p.s.i. when operated at 1,750 r.p.m. A 6-inch diameter overboard suction line was connected to a foot valve. Connecting the pump and dredge were 320 feet of 6-inch inside diameter hose.

The dredge was often towed with a 300-foot-long, $1\frac{1}{8}$-inch diameter, nylon rope. The dredge was set and retrieved with a $\frac{5}{8}$-inch diameter, 6-conductor, electro-mechanical cable.

A double axis tilt indicator with a range of -45° to $+45^{\circ}$ was mounted on the dredge and connected to a pilothouse readout by the 6-conductor cable. A 3-wheeled tensiometer remotely indicated cable tension in the pilothouse.

DEVELOPING CLAM-DREDGING TECHNIQUES FOR SAMPLING WASHINGTON-OREGON COAST

The first objective was to test and modify clam-dredging equipment to sample sandy bottom for clams.

Dredge performance was monitored by the tilt indicator and tensiometer and, sometimes, by divers. The tilt indicator, mounted on arm that swung as dredge dug into bottom, indicated depth to which the dredge dug and its sideways tilt. It was usually possible to determine bottom type and hardness by noting dredge performance as shown on tilt indicator. When sideways tilt and digging depth remained constant, crew knew that the dredge was hung up. Divers observed the dredge during 11 tows and made observations in the furrow of 16 tows.

Both the $1\frac{1}{4}$-inch nylon rope and 6-inch hose were wrapped up on the net reel, allowing them to be rapidly set and retrieved.

Results

Initially, the dredge quickly filled with sand. Much less sand was retained by the dredge after these 3 modifications were made: (1) the $3\frac{1}{2}$-inch webbing covering the cage, which quickly became plugged with worm cases, was replaced with $\frac{1}{2}$-inch diameter rods set about $2\frac{1}{2}$-inches apart (center-to-center); (2) the solid digging plate was replaced by a slotted digging plate, allowing sand to be forced through it; and (3) fourteen $\frac{1}{2}$-inch jets directed toward top of dredge cage were installed in aft portion of dredge cage.

The dredge immediately became plugged on clay bottom. No attempt was made to correct this problem. Rocks, which were supposed to drop out an opening behind the cutting blade, were caught in large quantities.

While being set and retrieved, sharp edges on dredge cut into vessel. To prevent further damage to vessel, 3-inch pipe was welded along the side of dredge, and a guard made of 8-inch pipe was welded on the front of dredge.

The dredge frame, cutting blade, washout guard, and manifold proved much too weak and had to be strengthened.

When the slotted digging plate was first used, the dredge continually leaned over on its port side. The dredge usually stayed upright after its towing point was moved down to lowest point possible, the 45° elbow on dredge manifold was replaced with a 90° elbow, and more tow line was let out to reduce size of hose loop behind dredge. The dredge did not work well enough to justify further use. A new dredge, similar to present East Coast hydraulic surf clam dredges, will be designed and built.

Towing Speed

The dredge traveled only 0.4 knot to 0.7 knot when set to dig 15 inches, and about 1,600 gallons of water per minute were

delivered to dredge at 80 p.s.i. A tow rope tension of about 2,600 pounds was maintained. These speeds are much below the 2 to $2\frac{1}{2}$ knots maintained by East Coast commercial clam fishermen.

Suction Hoses and Priming System

Several imperfections were apparent. The deck hose provided insufficient water to quickly fill the pump and suction hose. The foot valve allowed some water to leak out when vessel turned. The 90° swivel elbow could not be brought completely inboard of vessel guard; this made it necessary to take suction hose off when passing through locks and when docking on starboard side.

Vessel Lifting Gear

The dredge was lifted aboard after every tow, using the mast, boom, and hydraulic boom winch. Although this procedure works well in protected waters, it is unsuitable offshore because it allows the dredge to swing dangerously.

On occasions, when dredge picked up heavy load of substrate material, the hydraulic boom winch was unable to lift dredge. A block and tackle then had to be used to lift dredge aboard.

Sorting clams from bottom sediment, shell, and other trash proved time-consuming. A sorting table will be built for future work. Eleven samples per day can be collected with this equipment when no breakdowns occur. Use of a proper sorting table should increase rate to about 15.

When moving from one station to another, a speed of 8 knots was maintained. The hose and dredge were towed just beneath water surface.

Quality of sample

Although the dredge did roughly indicate relative abundance of clams, the present dredging system does not give a good quantitative sample for these reasons: (1) when digging jets are adjusted to hit ahead of cutting blade, clams are sometimes washed under cutting blade, especially on soft sediments; (2) it is difficult to determine distance sampled; (3) the dredge continues to cut a shallow trench when it is winched in; (4) dredge often skips; (5) if long tows are made, dredge fills with subsequent material (including clams) thrown out sides and top; (6) since slats must be kept widely spaced to filter sand, gravel, and mud, many small clams are lost; (7) in some areas, geoducks (very large, edible clams) were available but dredge dug only deep enough to cut off their necks.

Despite these shortcomings, dredge has 2 good features. It samples a large area (30 inches wide and 50 to 500 feet long) and penetrates substrate down to 17 inches.

Geoducks

Despite efforts to avoid catching geoducks, they were abundant in a small area at head of Quartermaster Harbor and over large area in Useless Bay. During 187 minutes of towing, 1,484 geoduck necks and 61 whole geoducks were caught in Useless Bay. Divers reported many necks were left in furrow. Crew encountered average of 0.6 geoduck per square yard, and maximum of 1.5 geoducks per square yard. (These figures include number of necks estimated left behind in furrow.)

EFFECTIVENESS OF MODIFIED HYDRAULIC DREDGE ON LITTLENECK AND BUTTER CLAM BEDS

Dredging efficiency was assessed in Agate Passage, where known clam concentrations exist. The procedure was to dredge 125 to 200 yards, mark beginning and end of haul with marker buoys. Two diver teams (one BCF, the other Washington State) then determined density of clams in 2-square-foot areas in and adjacent to dredge furrow at 25-yard intervals using gold dredges. The divers also noted damaged clams and clams dug out by dredge but not retained by it.

Results

The 2 most numerous clam species were the butter clam (Saxidomus giganteus) and littleneck clam (Protothaca staminea). Catches ranged from 11 to 499 clams (2 bushels) for butter clams, and 4 to 912 clams (1.1 bushels) for littlenecks. The proportion of butter clams retained by dredge to number estimated that should have been caught based on divers density figures, ranged from 4 to 48 percent; overall percentage was only 17 percent. The dredge caught an average of only 9 percent of estimated number of littleneck clams in its path. In the worst tow, it caught only one percent of littleneck clams;

n the best tow, it caught 27 percent. Dredge performance would have been better had shorter tows been made and dredge been properly adjusted.

CONDITION OF SUBSTRATE AND FAUNA AFTER DREDGING

The aftereffects of dredging on substrate and fauna in Agate Passage were investigated by the Washington State divers who examined the tracks of 3 dredge hauls.

Nine Days After Dredging

Track 52 (catch: 499 butter clams, 912 littlenecks, and 13 geoducks). This had filled in somewhat but was still very evident. All littleneck clams and butter clams that were evident along and in this track shortly after dredging had disappeared. There were some empty shells of recently killed clams but no live ones. The uninjured clams apparently had dug back into the substrate. The injured ones, or ones that failed to dig back in were soon consumed by starfish (Pisaster). There was no evidence of any extensive decomposition of dead clams. Live healthy butter clams and littleneck clams were buried in track bottom, apparently little affected by dredge. Many fish (flounders, sole, ratfish) were observed along track. The hardshell clams left exposed by dredging either were eaten by scavengers or had redug back into substrates soon after dredging.

Track 56 (catch: 181 butter clams, 4 littlenecks, and 74 geoducks). This track was made in very soft sand and broken shell substrate. It had changed very little since May 1, when it was made. There were geoducks, whole and injured (mainly siphons clipped off) laying beside and in track. Starfish (Pycnopodia) were eating whole and injured geoducks. Some geoducks in bottom of track, which had siphons clipped, were being attacked by Pycnopodia. The starfish apparently were digesting injured siphons by digging depressions over geoducks and applying their stomachs next to tips of injured siphons. There were large holes in track where dredge apparently stopped its forward motion, allowing jets to dig in. Some holes were 3 feet deep and 5 to 6 feet across. One hole contained 5 injured geoducks laying completely uncovered at bottom of hole. No apparent fouling of substrate by decomposing clams was evident.

Diver Observations 3 Weeks After Dredging

Track 60 (catch: 420 butter clams, 787 littlenecks). The track had changed little since dredging. Test gold dredge holes were still evident along side of and in track itself. Large concentrations of starfish (Pisaster) were still evident and concentrated in track. Apparently, they were still feeding on clams disturbed by dredging. No evidence of problems due to decomposition of clams and other organisms was apparent.

AVAILABILITY OF CLAMS ON ALDEN BANK, IN HALE PASSAGE, AND NORTHEAST OF GUEMES ISLAND

On Alden Bank, 25 tows were made ranging from 4 to 14 fathoms but mostly from 5 to 9 fathoms. Most of the bank was rocky, causing considerable damage to dredge. A 50-acre area containing Humilaria and Saidomus giganteus (butter clam) was found in southwest corner. Eight tows in this area averaged 50 pounds per 3-minute tow. The dredge brought up much potato-sized rock and some shell, gravel, and mud.

Although clams were present in immediately surrounding area, large rocks prevented dredging.

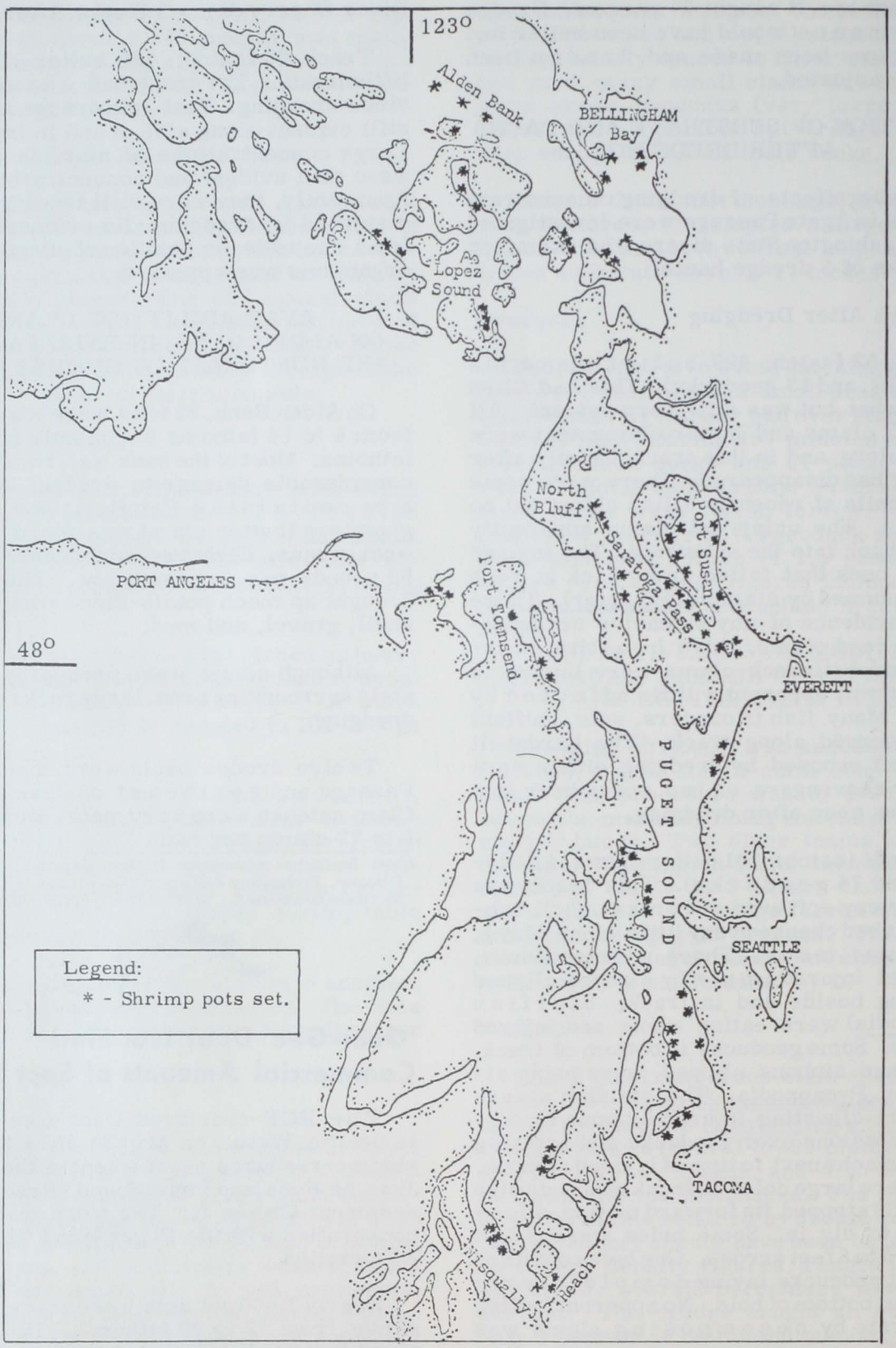
Twelve dredge hauls were made in Hale Passage and northeast of Guemes Island. Clam catches were very poor, ranging from 1 to 72 clams per haul.

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

'Geor-Gee' Does Not Find Commercial Amounts of Spot Shrimp

The BCF-chartered Geor-Gee returned to Seattle, Wash., on May 31 after 30 days of shrimp-resource assessment in the Strait of Juan de Fuca and Puget Sound (Resource Assessment Cruise 1). The work was done in cooperation with the Puget Sound Gillnetter's Association.

Nearly 2,400 pot sets were made at bottom depths from 12 to 90 fathoms. "No area was found that produced spot shrimp in quantities



BCF-chartered vessel Geor-Gee shrimp assessment, April 29-May 31, 1968.

considered adequate for commercial exploitation." The largest catches were made on the west side of Lopez Island. There, a string of 26 pots set in depths from 19 to 23 fathoms caught 207 spot shrimp and 198 coonstripe shrimp (Pandalus hypsinotus). One pot contained 42 spot shrimp and 2 coonstripe shrimp. A string of 25 pots set in 20 to 25 fathoms adjacent to the above string produced no spot shrimp--but it caught 572 coonstripe shrimp. Average size of the spot shrimp was 14 to the pound, heads-on. Coonstripe shrimp averaged 44 to the pound, heads-on. Additional areas in which fair catches of spot, coonstripe, and pink shrimp (Pandalus jordani) were made included Elger Bay and North Bluff in Saratoga Passage, Post Point and Point Frances in Bellingham Bay and also in Port Susan. Waters of southern Puget Sound produced very small catches of shrimp.

Throughout the survey, incidental catches of various fish and invertebrates were made.

Objectives

The cruise's major objectives were to: (1) determine the distribution and availability of the prawn-sized spot shrimp (Pandalus platyceros) in areas of Puget Sound and adjacent waters--except in Hoods Canal and Elliott Bay, where limited commercial shrimp fisheries exist; (2) evaluate feasibility of establishing new shrimp fisheries that would employ west coast gillnet-trawler-type vessels; and (3) collect biological data on shrimp.

Fishing Gear

Rectangular commercial-type shrimp pots were used. Each pot had a 20-inch by 32-inch by 16-inch framework fabricated from $\frac{3}{8}$-inch steel rod; each pot was covered with #18 thread, $1\frac{1}{2}$-inch mesh nylon webbing. A tunnel about 12 inches deep terminating with a 3-inch entrance was built into each end. Bait containers were made from pint-size, screw-lid, plastic freezer containers. A series of $\frac{1}{16}$-inch holes was drilled into each container. A heavy stainless steel wire, bent to form a tight hook, was fastened to each container to provide a means of hanging it in the center of the pot. Brine-immersed, cut, frozen herring were used as bait.

Methods

The survey was conducted in areas of Puget Sound from Alden Bank on the north to Nisqually Reach on the south (chart). Fishing was restricted primarily to areas where past experience and the environment suggested shrimp might be present.

Each day 80 pots were fished. These were divided into 3 independent strings of 25 to 28 pots. The pots were attached at 10-fathom intervals along a ground line. Whenever possible, strings were set perpendicular to bottom contours in such a manner that a string covered bottom depths from 20 to 90 fathoms. Pot baits were replaced every second day. Normal procedure was to set the strings of pots about midday, allow them to fish overnight, and to haul them the following morning. This resulted in a "soaking" time of about 20 hours.

'Oregon' Explores for Scallops Off Florida

The BCF's R/V Oregon returned to St. Simons Island, Georgia, on June 26 after 17 days of scallop explorations off Florida's east coast. (Cruise 130, 6/10-26/68.) This was the seventh in a series of industrial development cruises to keep an up-to-date check on the Florida east coast calico scallop (Pecten gibbus) grounds.

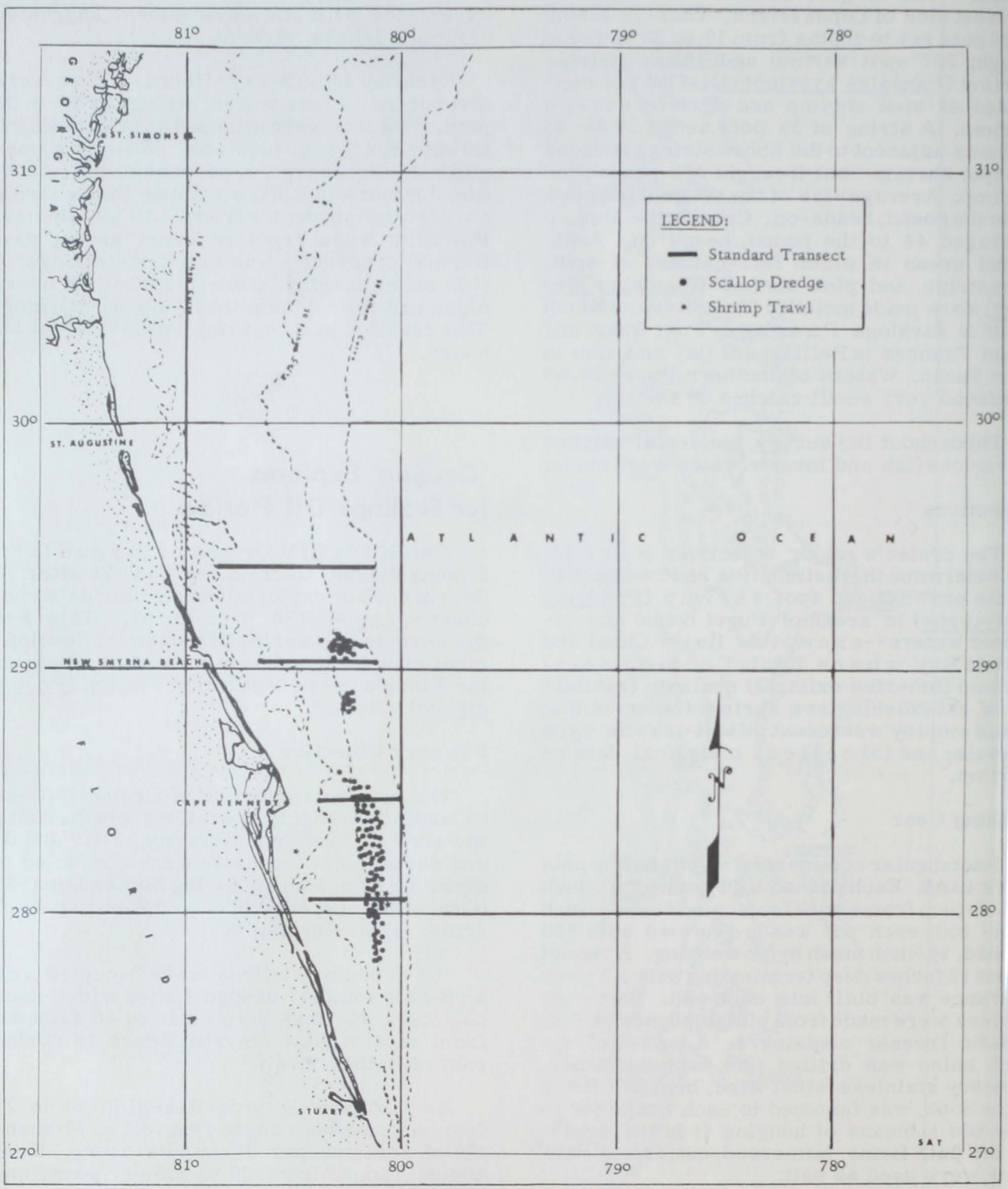
Primary Objective

The principal objective of Cruise 130 was to continue dredging operations, emphasizing the area south of Cape Kennedy. Four standard assessment transects were conducted in areas established during September 1967 (Cruise No. 121) and occupied during each cruise in the series.

181 dredging stations were occupied with an 8-foot tumbler dredge fished with 2-inch bag rings 20 rings deep in 10 to 40 fathoms from east of New Smyrna Beach to northeast of Bethel Shoal.

East of New Smyrna Beach, in 24 to 27 fathoms, catches ranged from 3.1 to 17 bushels of scallops per 30-minute drag. Meat counts ranged from 80 to 105 per pound and yielded 2.75 to 4.1 pounds per bushel.

Northeast of Cape Kennedy, catch rates ranged from 1.9 to 18 bushels per 30-minute



Oregon Cruise 130, June 10-26, 1968.

drag in 24 to 26 fathoms. Counts ranged from 74 to 100 meats per pound and yielded 3 to 3.4 pounds per bushel.

In the southern area, from east of Cocoa Beach to east of Sebastian, catches ranged from 3.6 to 22 bushels per 30-minute drag in 21-24 fathoms. Counts ranged from 116 to 160 meats per pound and yielded 2 to 3.8 pounds per bushel.

Meat Yields

On the average, meat yields north of Cape Kennedy were higher than during May (Cruise 128); south of the Cape, meat yields were slightly lower.

Two days of dredging demonstrations were conducted for industry observers. Fishing information and assistance were provided to vessels in the scallop fishery.

Shrimp

Four nighttime drags were made east of Melbourne, Fla., in 10-23 fathoms with a 65-foot, two-seam shrimp trawl fished on 8-foot chain doors. The drags were made to obtain shrimp for use in evaluating an industry-developed, shipboard shrimp-heading machine. Catches of 21/25 count (heads off) brown and pink shrimp (Penaeus aztecus and P. duorarum) were small; they ranged up to 7 pounds per 60-minute drag.

'Cromwell' Conducts Bottom Trawling Survey Around Hawaii

BCF's research vessel Townsend Cromwell returned from a 2-week cruise to investigate the bottom fishery resources around the Hawaiian Islands. The Cromwell cruised from the island of Hawaii to Necker Island in the Leeward group.

This was the third in a series of cruises designed to investigate the inshore waters to 500 fathoms (3,000 feet) around the major Hawaiian Islands. The investigations are being conducted in cooperation with the Hawaii Institute of Marine Biology, University of Hawaii.

Problems of Fishing Deep

The vessel used primarily Gulf-of-Mexico-type shrimp trawls to investigate the bottom and near-bottom fishery resources. Off Kawaihae, Hawaii, however, she used other fishing gear to try to capture what may have been fishes recorded on fish-finding depth recorders. Here, at 1,200 feet, the crew fished bottom handlines, gill nets and longline gear, and set some fish traps. Fishing at such great depths produced many problems. Much fishing gear was lost while being hauled up. However, the longline gear was retrieved successfully. This gear's catch was entirely a small species of shark not commonly caught around the islands. It is not certain whether these were responsible for the "fish traces" on the depth recorder.

Checked Shrimp Areas

The Cromwell's scientists were interested in any bottom fish or crustacean that offers commercial potentials--but particularly in the Royal Hawaiian shrimp found in significant quantities in certain areas on the series' first cruise. During the cruise, new shrimp grounds were located off Haleiwa in about 50 to 60 fathoms. The bottom there has some rough spots; in 2 of the drags, the shrimp trawl nets were torn.

The ship also investigated the areas where shrimp were found in earlier cruises. In Pailolo Channel, the channel between Maui and Molokai, concentrations of shrimp were still present. Catches up to 19 pounds in a $4\frac{1}{2}$-mile drag were made. Off Molokai's west coast, close to Penguin Banks, where shrimp also had been found, the shrimp were more abundant this time. This was reported by Howard O. Yoshida, who directed scientific activities. In 2 trawl drags of 4 and $4\frac{1}{2}$ miles, 15 and 35 pounds of Royal Hawaiian shrimp were caught.

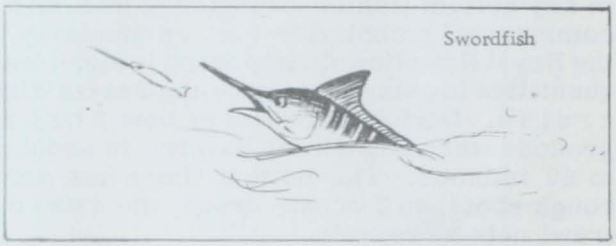
Fishes & Crustaceans Caught

The shrimp trawls also caught fishes and other crustaceans besides shrimp. About 100 species of fishes were caught. Many of these were known only from few specimens before this series of cruises. Of particular interest was the capture of a scorpionfish, known only from a few specimens throughout the world. In one trawl drag south of Honolulu, on bottom more than 2,000 feet deep, 221 specimens

were brought up. Fishery biologist Everet C. Jones, who acted as curator of invertebrates, noted that white crabs and spiny lobsters, which have a ready market in Hawaii, also were caught by the shrimp trawls.

'Miss Behavior' Studies Use of Longline to Capture Swordfish

The Miss Behavior of BCF's La Jolla, Calif., Fishery-Oceanography Center, returned to San Diego on July 1 after a cruise designed to study the use of longline method to capture swordfish (Xiphias gladius). The goal is to improve the efficiency of methods and to enlarge the scope of present fishery. Another major cruise objective was to obtain information on the life history of swordfish. (Swordfish I, June 20-July 1.)



The longline gear was made up of:

Mainline	- $\frac{1}{4}$ inch nylon
Dropper lines	- $\frac{3}{16}$ inch nylon, $3\frac{1}{2}$ fathoms long.
Hooks	- Mustad Shark Hook, 3/0.
Floats	- Oxygen tanks and rubber inner tubes; float lines 5 fathoms.

Dropper lines were attached to the main line by detachable A/K snaps and spaced 12 fathoms apart. Hooks were spliced directly on the dropper lines, without wire leaders. Floats were used between 10-hook units. A radio buoy, a light buoy, and radar reflectors were used to help recover the gear. A pressure depth gauge and a BKG were used to measure depths fished by the gear. Squid (Ommastrephes sp.) was used exclusively as bait. All sets were made at about sunset; hauling usually started at 0600, except when gear was not located until later. All sets were made between the 100- and 1,000-fathom curves.

RESULTS

Set No. 1 - June 22-23. Position latitude 27°31' N., longitude 115°07' W.; surface temperature 15.6° C. 400 hooks. Catch: about 125 blue sharks (Prionace glauca).

Set No. 2 - June 23-24. Position latitude 27°03' N., 114°34' W.; surface temperature 18.0° C. 367 hooks. Catch: one yellowfin tuna (Thunnus albacares, 124 cm.); about 110 blue sharks.

Set No. 3 - June 26-27. Position latitude 23°30' N., longitude 111°10' W.; surface temperature 21.7° C. 268 hooks. Catch: 2 dolphins (Coryphaena hippurus); one scalloped hammerhead shark (Sphyrna lewini); 16 blue sharks.

Set No. 4 - June 27-28. Position latitude 25°02' N., 112°51' W.; surface temperature 19.6° C. 180 hooks. Catch: 9 blue sharks.

Set No. 5 - June 28-29. Position latitude 25°29' N., longitude 113°26' W.; surface temperature 18.7° C. 275 hooks. Catch: one scalloped hammerhead shark; 45 blue sharks. [Note: about one-half the gear (140 hooks) was lost and not recovered.]

About the Operation

The hydraulic powered drum used for hauling and storing the main line performed satisfactorily. Setting time averaged 23.5 minutes per hundred hooks, including time required to change reels. Under normal conditions, hauling time averaged 34 minutes per hundred hooks; tangling of mainline by the large numbers of blue sharks captured caused frequent delays in hauling. The deepest hooks in the 10-hook units fished at a depth of 55-60 meters, according to measurement with a BKG and a depth recorder.

The Swordfish Fishery

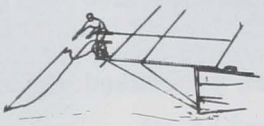
Longline catches of swordfish on the U. S. east coast are high during and after the surface harpoon fishery. The highest catches do not necessarily coincide with areas of greatest surface abundance.

The Japanese longline fishery only recently started to operate off Baja California. Most effort has been expended from September through December. Although striped marlin

was the principal species sought, many swordfish also were caught. A small percentage of longline sets was made specifically to catch swordfish--i.e., night fishing with squid as bait, and modification of gear to fish shallower. The catch distribution is thought to be associated with complex subsurface thermal structures. Data from the Pacific coast is insufficient to support or negate this hypothesis. However, surface fish are known to be present off Baja California in June; one was sighted.

The Miss Behavior scientists said: "No explanations can be offered for our failure to encounter subsurface swordfish during our cruise. As far as we know, our effort represents the first time that longline swordfish gear has been used off Baja California in the month of June."

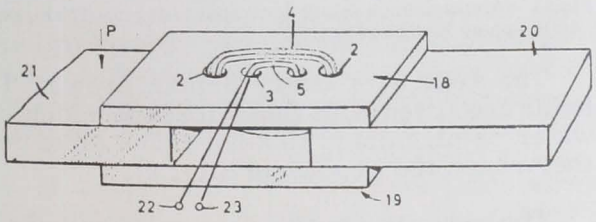
They add: "A few modifications would greatly increase the efficiency of the operation. Specifically, a larger reel and stand, capable of holding all the mainline, would make it possible to work the gear with a minimum of 3 or 4 men."



REVERSING A SONAR PRINCIPLE

When a piece of iron or other ferromagnetic material is placed in a strong magnetic field, it is deformed. This principle, called magnetostriction, is used in sonar, where a varying magnetic field causes a transducer to vibrate, causing sound waves in the water.

An invention patented recently turns the principle around, and measures force, which causes the iron to change shape, by the change in magnetic field. The output is an electric current, making the device useful for automatic control situations.



In the new device, patented by a Swedish inventor, Olof W. Ohlsson, four holes are bored in the ferromagnetic block--two for a magnetizing wire and two for a measuring wire. An electric current in the magnetizing circuit causes a voltage to be induced in the measuring wire; but this measured voltage depends on the magnetic qualities of the material--its permeability.

If a force is applied to the material, its permeability changes, and the measured voltage changes with it.

Inventor Ohlsson found that by placing the two holes for the measuring circuit in between the holes for the magnetizing wire, the induced magnetic field had its greatest effect, making the device more sensitive. (Reprinted with permission form "Science News," weekly summary of current science, copyrighted 1966 by Science Service, Inc.)