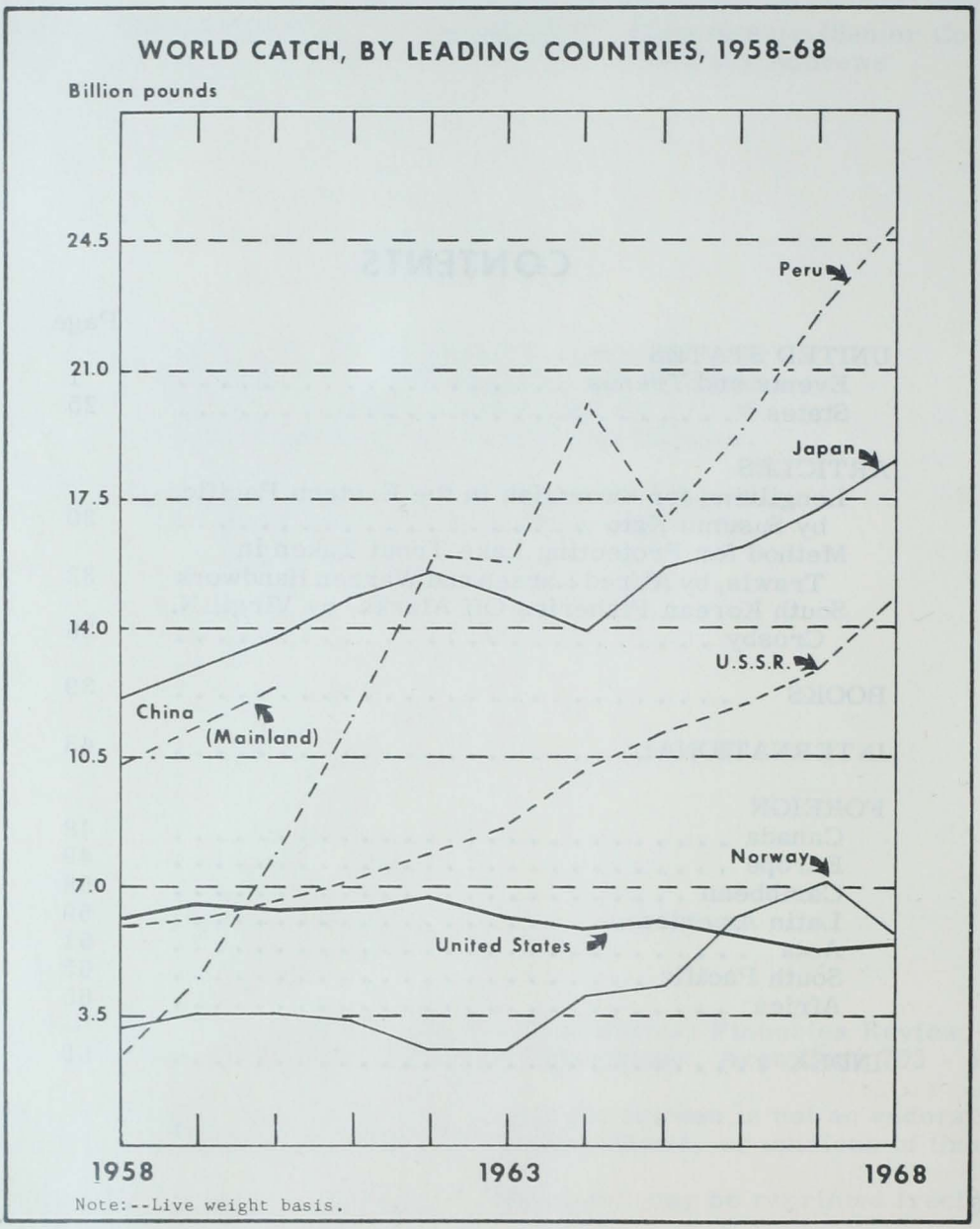

WORLD CATCH, BY LEADING COUNTRIES, 1958-68
Billion pounds
24.5
21.0
17.5
14.0
10.5
7.0
3.5
Peru
Japan
U.S.S.R.
China
(Mainland)
Norway
United States
1958
1963
1968
Note:--Live weight basis.

U.S. FISHERMEN CAUGHT 4.1 BILLION POUNDS IN 1968 WORTH $471.5 MILLION

In 1968, U.S. fishermen caught 4.1 billion pounds of fishery products, which they sold for $471.5 million. This was almost $32 million more than their 1967 sales--and nearly equal to the record $472.4 million they received for their larger 1966 catch of 4.4 billion pounds. These data are contained in BCF's "Fisheries of The United States... 1968."

Declining sharply were landings of anchovies, haddock, Pacific hake, tuna, blue crabs, and king crabs.

Also lower were catches of alewives, Pacific halibut, and shrimp.

The total catch would have dropped below 1967's except for greater landings of menhaden, Pacific salmon, sea herring, jack mackerel, and yellowtail flounders. And there were record catches of shrimp in Maine and Oregon waters, albacore tuna off Oregon, and northern and spiny lobsters.

How Catch Was Used

In 1968, about 2.3 billion pounds of the domestic catch were used as food for people.

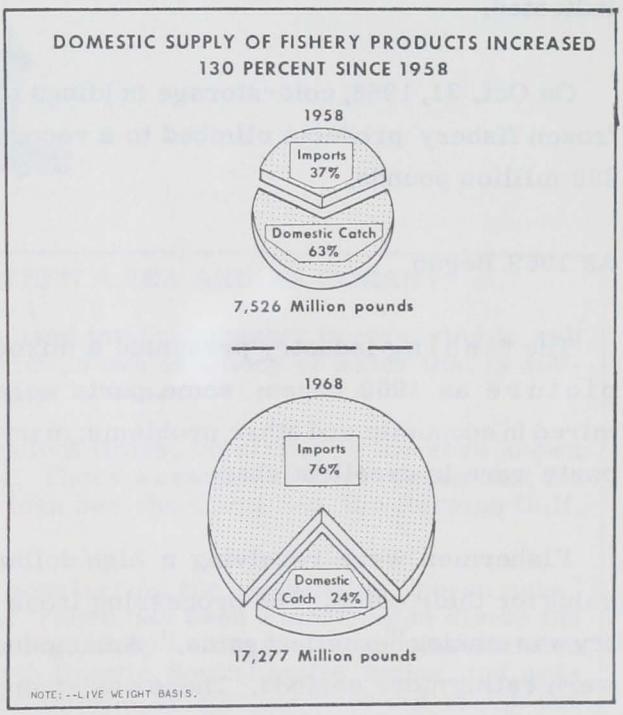
The total 1968 catch for food was marketed as follows: 1,503 million pounds (round weight) fresh and frozen; 970 million for canning (includes animal food); 76 million for cured products; and 1,567 million for reduction to meal, oil, etc.

Record 11.46¢ A Pound

In 1968, the average price-per-pound paid to fishermen hit a record 11.46 cents. In 1967, it had been 10.84; in 1966, 10.81 cents.

PROCESSED FISHERY PRODUCTS

The value of U.S.-processed fishery products from domestic and imported raw material was $1.3 billion--about 7% above 1967.



The canned pack of 43.4 million standard cases was worth a record $580.6 million.

Record packs of tuna and pet food were achieved. There were large increases in canned production of Pacific salmon, Maine sardines, mackerel, and shrimp.

The fish stick and portion industry set records: 270.7 million pounds worth $108.8 million.

Processors of breaded shrimp produced 103.7 million pounds worth a record $98.5 million.

Groundfish-fillet production was less than in 1967, "but producers of other type fillets had a relatively good year."

Processors of fish and shellfish specialty dinners--and other packaged products--produced more. Continued industry growth was indicated.

On Oct. 31, 1968, cold-storage holdings of frozen fishery products climbed to a record 288 million pounds.

As 1969 Began

The fishing industry presented a mixed picture as 1969 began: some parts were mired in economic and other problems; many parts were in excellent shape.

Fishermen were receiving a high dollar value for their catch. The processing industry was making "excellent gains." Americans were eating more seafood. There was strong demand throughout 1968 for "some canned products, fish sticks and portions, fillets and steaks, lobster products, shrimp items, and fish and shellfish specialty dinners, etc."

Per-capita consumption reached 11 pounds in 1968, the highest since 1954.

IMPORTS

In 1968, the U.S. imported 13.2 billion pounds (live weight) of all fishery products, far exceeding 1967's high of 9.9 billion pounds.

The value of imports was $798 million, $90 million higher than the 1966 record of $708 million.

Of the 13.2 billion pounds, 3.2 billion were edible fishery products; 10 billion were industrial fishery products (33% above 1967's record 7.5 billion).

SOME HIGHLIGHTS

- Domestic shrimp fishermen were paid a record $113.3 million for their catch. For the second consecutive year, this fishery exceeded $100 million.

- Shrimp accounted for 24% of the total U.S. value paid for all species.

- The menhaden catch of 1.4 billion pounds was 34% of total catch.

- Louisiana led all States in volume of catch--747.5 million pounds. It was followed by California, 446.1 million pounds; Alaska, 433.7 million pounds; Virginia, 388.5 million pounds; and Massachusetts, 337.4 million pounds.

- Alaska was No. 1 in value of catch: $71.6 million. Then came California, $53.3 million; Texas, $44.2 million; Massachusetts, $41.6 million; and Louisiana, $40.6 million.

• For the 20th consecutive year, San Pedro, California, led all domestic fishing ports in value of catch: $29.1 million.

• U.S. foreign trade in fishery products was a record $865.8 million in 1968--up $75.7 million.

• A new and potentially important Alaska sea-scallop fishery began in 1968. Nearly 2 million pounds of sea scallop meats were landed.

• In 1968, construction of shrimp trawlers continued at a record pace. At least 350 new vessels joined the Gulf shrimp fleet.

WORLD FISHING

Peru led the world in fishery landings--followed by Japan, China (Mainland), USSR, Norway, and U.S. But world ranking by value is considerably different. Here, Japan leads, followed by the U.S. Peru ranks about 15th, and the USSR might be lower.

Japan led the world in per-capita consumption of fishery products with 61.2 pounds of edible meat. Then came Denmark, 47.5; Sweden, 45.1; Norway and Portugal, 43.4 each; the Philippines, 33.8.

WHAT IS THE DIFFERENCE BETWEEN A SEA AND AN OCEAN?

The terms "sea" and "ocean" are often used interchangeably in referring to salt water. However, from a geographic point of view, a sea is a body of water that is substantially smaller than an ocean or is part of an ocean.

The term "seven seas" dates back to ancient times, referring to the seas known to the Mohammedans before the 15th century. These were the Mediterranean Sea, the Red Sea, the East African Sea, the West African Sea, the China Sea, the Persian Gulf, and the Indian Ocean.

In more recent times, Rudyard Kipling popularized the expression "seven seas" by using it as the title of a volume of poems. There has been a tendency to divide the world's ocean into seven oceans to retain this legendary number. The popular division is Arctic, North Atlantic, South Atlantic, North Pacific, South Pacific, Indian, and Antarctic. However, International Hydrographic Bureau at Monaco does not accept the existence of an Antarctic Ocean. Actually, of course, all limits of oceans are arbitrary, as there is only one global sea. The International Hydrographic Bureau subdivisions are primarily for the purpose of filing Notices to Mariners and have little to do with natural boundaries.

The International Hydrographic Bureau lists 54 seas; some are seas within seas. The Mediterranean Sea contains seven seas so one could sail the seven seas (of the Mediterranean) without ever venturing into an ocean. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

UNITED STATES

Gloucester Herring-Alewife Fishery Rises Sharply

Prior to 1967, the herring-alewife catch landed at Gloucester, Mass., was relatively small. During 1967 and 1968, however, one firm operated a reduction plant at Gloucester using these species caught by U.S. and foreign vessels. As a result, the annual catch has risen sharply:

	Catch		
	Alewife	Herring	Total
	(Million Pounds)		
1965	0.006	-	0.006
1966	0.006	0.001	0.007
1967	4.246	11.741	15,987
1968	-	53.727	53.727

1968 Herring Catches

In 1968, 21,037,000 pounds of herring were taken by U.S. vessels, 32,320,000 pounds by Canadian vessels, and 370,000 pounds by an Icelandic seiner. The Canadian and Icelandic catches were transferred at sea for delivery to the Gloucester firm.

The Canadian vessels are 100-foot-class combination purse seiners-otter trawlers, equipped with power blocks and sonar. These vessels fish with a seine skiff and fish seines 40 to 50 fathoms deep, and 250 to 350 fathoms long. The Icelandic vessel used a 120-fathom-deep purse seine.

BCF Explorations

In April, BCF's exploratory fishing research vessel 'Delaware II' conducted surveys to locate and sample commercial abundance of herring and red hake concentrations. Surveys and experimental fishing were carried out with a midwater trawl and a high-opening bottom trawl.

Study Spring Spawning of Georges Bank Haddock

The 1969 spring spawning of Georges Bank haddock was followed carefully by BCF's Woods Hole (Mass.) Laboratory. A sampling schedule was set for January-July with weekly samples from the commercial fleet and from BCF's 'Albatross IV'. Arrangements were made with Boston trawler skippers to supply fish landed in the round to provide gonads for examination.

Observations Began in 1968

The study continues observations begun in 1968. It was noted then that peak spawning did not occur until late April. This was considerably later than indicated by plankton surveys in previous years.

The Georges Bank haddock stock is in serious condition because of low survival of year-classes for the past 5 years. The cause is unknown. An intensive study of spawning process and fate of the spawn is essential to understand recruitment of fish to the fishery. The examination of gonads during spawning season is an important part of study.

Demand for Ocean Quahogs Grows

There is growing interest in the supply and use of ocean quahogs, Artica islandica. This is due to the success of a Rhode Island firm in using the ocean quahogs in its products--and to experiments at BCF's Gloucester (Mass.) Technological Laboratory. The experiments showed these clams to have potential food uses. The lab has received inquiries from several firms.

State Interested

Massachusetts is interested in the potential and promotion of ocean quahogs. The State had learned of the work by BCF's Exploratory Fishing and Gear Research Base and the lab

to find the resource, prepare acceptable products, and to promote the species. State officials agreed to work with the lab to acquaint coastal towns of the ocean quahog fishery potential.

The 'Clambo'

BCF staff participated in the first public showing of a product made from minced ocean quahog held together as a pattie. The binder was produced from pulverized fish flesh, the 'clambo'. The clambo's flavor can be controlled by varying the amount of quahog, starch, and spices--and by varying particle size of components.

BCF's 'Oregon II' Finds Heavy Fish Concentrations Off Louisiana

During 4 weeks of exploration off Louisiana, BCF's Oregon II recorded heavy echo-sounder indications of schools of rough scad and round herring. The schools were located just off the bottom in 110 fathoms depth south of Cameron and extended for 35 miles.

Salmon & Steelhead Trout Culture Practiced

Aquatic husbandry is practiced in many ways with varying success. Among the most successful is the Federally supported hatchery system on the lower Columbia River. This releases young salmon and steelhead to be caught later by commercial and sport fishermen.

In 1967 alone, BCF estimates, the hatchery program contributed well over 15 million pounds to catches in the Columbia and off the west coast. The cost of producing the fish was less than half their value when caught.

Program Improvement Possible

A BCF study indicates that catches could be increased by 10.5 million pounds a year if existing hatchery stations and techniques were used to full capacity. The cost would be about one-sixth the resulting annual value; it would be lowered further as research findings and new techniques were applied.

BCF provides funds and administers the program, which is conducted cooperatively with Oregon, Washington, and Interior's Bureau of Sport Fisheries and Wildlife.

Record Stocking of Fish in Great Lakes Scheduled

About 11.7 million hatchery-reared fish, principally salmon and lake trout, were scheduled to be planted in the Great Lakes in spring 1969. This will be more than 3 million above the 1968 high, according to the Great Lakes Commission.

Two major agencies are trying to rebuild the sport and commercial fish stocks: Michigan's Department of Natural Resources, which will release about 5.2 million salmon and steelhead (rainbow) trout, and the Great Lakes Fishery Commission, which will direct planting of 5.1 million lake trout. Also, the spring stocking programs of conservation agencies in New York, Ohio, Pennsylvania, and Wisconsin will include larger salmon plantings than their 1968 introductory releases, and the stocking of other game fish. Minnesota and Ontario will make their first coho plantings.

Where Released

Michigan's record-level fish-planting program will involve 41 streams tributary to lakes Michigan, Superior, and Huron. The coho salmon release of 3,950,000 smolt (yearlings) will go into 26 streams: Lake Michigan 2.9 million; Lake Superior 500,000; Lake Huron 550,000.

For the 900,000 young chinook salmon, the plantings by lake basin will be: Michigan 650,000; Huron 200,000; Superior 50,000.

The schedule for 320,000 steelheads or lake-run rainbow trout calls for releases in 22 streams: Michigan 205,000; Superior 55,000; Huron 60,000.

Lake Trout

The lake trout yearlings will be planted in lakes Superior and Michigan by the U.S.

Bureau of Sport Fisheries and Wildlife, and Minnesota, Wisconsin, and Ontario fishery agencies. The release of 3,097,000 trout in Superior will mark the fourth consecutive year over the 3-million mark. For Lake Michigan, 1969 is the first since the planting program began in 1965 that the number of trout released will be over 2 million (2,040,000). The waters of all four states bordering the lake will share this year's plantings.

Erie & Ontario

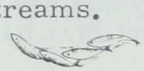
In the eastern Great Lakes--Erie and Ontario--last year's successful introduction of 143,000 cohos by Ohio, Pennsylvania, and New York has led these states to increase plantings to about 365,000 this spring. Ohio plantings in 4 locations will total about 95,000; in addition, 25,000 young rainbows will go into Lake Erie tributaries in the eastern section of the state. For Pennsylvania's Lake Erie streams, the release of coho smolt is expected to be about 125,000. New York coho plantings will total 145,000 fish: about 10,000 in a Lake Erie tributary. the remainder into impoundments on 3 Lake Ontario streams. The state also plans to release about 60,000 chinook salmon fingerlings in the Little Salmon River at the east end of Lake Ontario.

Ontario Province

The Province of Ontario will undertake its first coho plantings in the Great Lakes: 130,000 are scheduled for 3 streams at the west end of Lake Ontario; 20,000 will be placed in the Nipigon Bay area of Lake Superior. In addition to coho, the province will plant 35,000 splake (a lake trout-brook trout hybrid) in Georgian Bay, and rainbow trout in several Great Lakes areas.

Minnesota & Wisconsin

Minnesota's first coho release, about 100,000 yearlings, will be made in the French River, a Lake Superior tributary near Duluth. Wisconsin's initial planting of 25,000 coho in one Lake Michigan stream in 1968 will be expanded this spring to 5 streams; each will receive about 40,000 yearlings. Also, the state plans to place a total of 200,000 rainbow, brown and brook trout in Lake Michigan tributaries, and about the same number in Lake Superior streams.



East Coast Aquatic Plant Harms Clams and Oysters

A dark-green, cylindrical algae resembling forked macaroni appeared in 1957 at the eastern end of Long Island. Some fishermen call it 'spagetti weed.' Because it is a cold-water plant, it differs from the Codium (C. decorticatum) of the temperate and tropical waters of the east coasts of North and South America.

This plant grows so luxuriously it blankets the bottom and interferes with and destroys clams and oysters. It crowds out all other species. By 1962, it was observed near the mouth of Narragansett Bay and, later, in the Chatham and Cotuit areas of Cape Cod. The rizoids ('rootlets') or 'hold fasts' attach to hard objects on the bottom, including shellfish.

'Green Bumps' on Oysters

The 'green bumps' on oysters brought from Long Island and planted in Oyster River, Chatham, were the source of the Massachusetts invasion. The most recent reported infestation is Barnagat Bay, N.J. The State Conservation Department is trying to help shellfishermen salvage clams overgrown by Codium.

This subspecies of 'Codium frogile,' presumed native to Japan, spread throughout the Pacific and into the Atlantic. It was reported first in Europe around 1900. It thrives best in cold deep water and reproduces by fragmentation and zoospores (millions are released in February). ('Shellfish Soundings,' Feb. 26, 1969.)

Wisconsin U. Opens Eutrophication Center

An information center at the University of Wisconsin will provide researchers with many reference materials on eutrophication--"the aging process of surface waters enriched or fertilized by natural and waste-borne nutrients." This is reported by the Great Lakes Commission.

The Commission says the process is common to all water bodies. But man's activity has accelerated rates of aging--and upset

dramatically the balance of nature in more and more areas.

The eutrophication center will be associated closely with the research work of the University's Water Resources Center at Madison.

Demand for Fresh Fish Increases in Midwest

There is increasing demand for fresh fish in the midwest, report BCF personnel after interviewing distributors and retail buyers in several cities.

Several airlines, recognizing this demand, have maintained commodity rates for fishery products shipped to several points in the U.S. The airlines are looking into distribution problems faced by the fishing industry.

The Major Problem

The major need of distributors, retailers, and airlines is to locate a continuous supply of fresh products which would be shipped in suitable condition.

BCF sees a need for a uniform method of educating fresh-fish producers on the nature and potential of inter-regional markets.

Food Buyers from Abroad to Attend U.S. Conference

The U.S. Department of Agriculture and the Super Market Institute are sponsoring a conference for food buyers from abroad. It will be held in Atlantic City, N.J., May 11-14, 1969. By encouraging the world's top wholesale and retail food buyers to meet with their U.S. counterparts, the sponsors hope to build export markets for U.S. processed foods. U.S. Agricultural Attachés in leading dollar markets around the world have been promoting the conference. Many foreign importers have said they would attend.

A Switch for BCF

For BCF, which will participate, the conference turns around one of its important activities. For several years, BCF has been promoting exports of U.S. fishery products by taking part in foreign trade fair exhibits.

1969 'International Code of Signals' Is Available

The 1969 'International Code of Signals' is useful to all boat owners--of small craft using coastal waterways and of large offshore vessels. It answers questions about the meaning of flag hoists, how to signal for assistance, radio/telephone procedure, and ways to facilitate all types of necessary communication equipment of all seagoing vessels.

The book is available from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. Price: $4 a clothbound copy.

The Code of Signals was adopted in 1965 by the UN's Inter-Government Maritime Consultative Organization. It is also published by France, Italy, Germany, Japan, Spain, Norway, Soviet Union, and Greece. The Code is understood by all nations.

Revised Code Effective

The revised Code became effective April 1, 1969. It will be used by all ships of the U.S. Navy, Coast Guard, and Merchant Marine; Naval and Coast Guard radio and shore stations, private marine radio stations, and marine departments of steamship companies.

There are 446 signals for distress and emergency, 327 for casualties and damages; 328 for navigation and hydrography; 177 for maneuvers; 137 pertaining to cargo, crew, fishing, pilot, port and harbor; 169 for meteorology and weather; 13 for international sanitary regulations; and 503 for medical assistance and weather.

A Corredion

The picture story on Menhaden, CFR Jan. 1969, p. 16, should have said that today nearly all menhaden are used to make high protein fish meal.

'SEAFREEZE ATLANTIC' Sails on First Fishing Trip

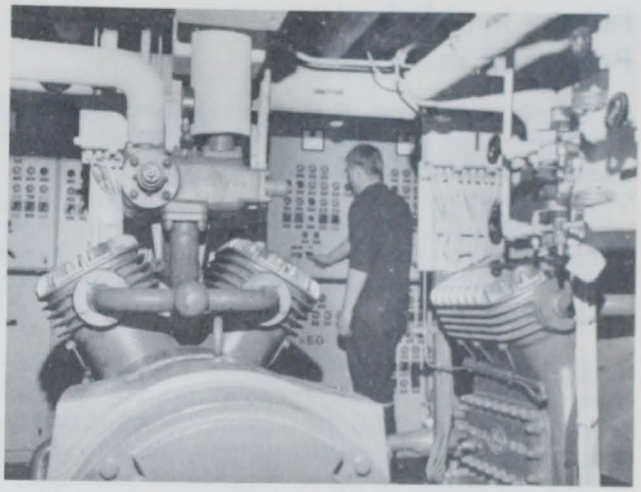
The largest fishing vessel to fly the U.S. flag--the 'SEAFREEZE ATLANTIC'--left its home port of New Bedford, Mass., March 28, 1969, on its first fishing trip. The $5 million, 297-foot, 3,120-ton freezer stern trawler will fish off Labrador "for anything that can be found in the water," a company spokesman said. He presumed the fish would be groundfish, codfish, and pollock.

The vessel cruises at 14.4 knots and can cover 26,000 miles. She is carrying a crew of 54 in air-conditioned cabins: 10 fishermen, 28 processing personnel, 7 in engineroom, and 9 officers.

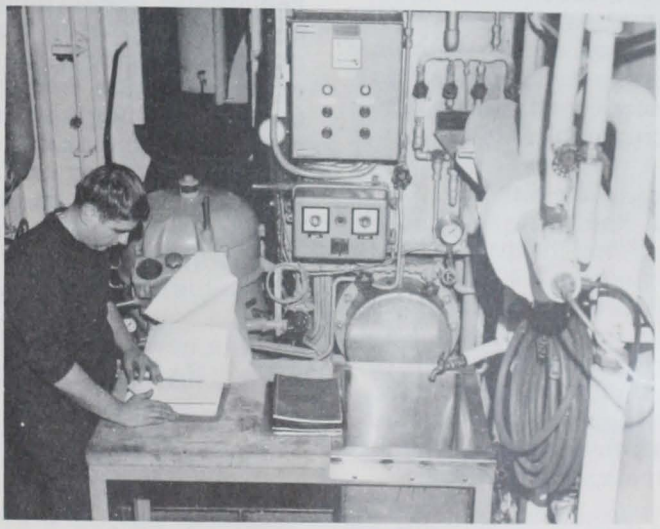
A sistership, the 'SEAFREEZE PACIFIC,' will fish off the Pacific Northwest from a West Coast port.

The trawlers can stay at sea 2 months and process their catch. They are equipped to use nearly everything they catch. Inedible or trash fish, and waste from the cleaning process, will be converted to fish meal and fish oils.

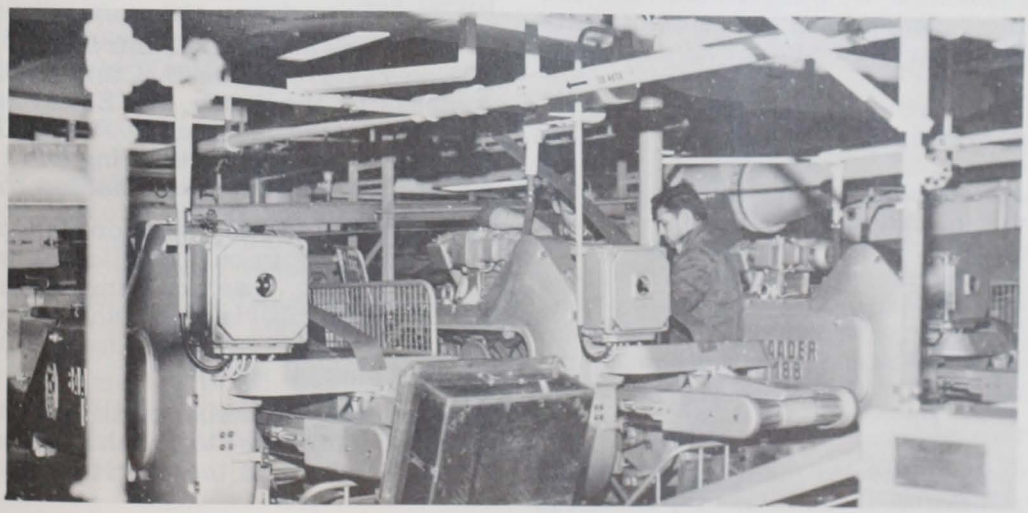
One of three tray freezing units.



Refrigeration plant.



Fish meal plant.



Filleting machines--fish processing factory.

(Photos: Robert K. Brigham)

Fishery Legislation Proposed in Congress

More members of Congress are showing their interest in greater utilization and conservation of ocean resources.

On Mar. 20, Sen. Magnuson introduced S. 1588, a bill to establish a National Institute of Marine Medicine and Pharmacology. Senators Fong and Pelly were cosponsors.

Speaking in support of the bill, Sen. Magnuson quoted a letter from a member of the Commission on Marine Sciences, Engineering, and Resources stating that "Marine bioactive substances as a source of new commercial pharmaceutical products constitute an almost completely unexplored area of research. At the present time there is not a single industrial organization or governmental agency that is making a continuous systematic exploration of new bioactive substances from marine creatures."

Quoting from a report of the National Conference on Drugs from the Sea, Aug. 1967, Sen. Magnuson added: "The Institute should be established for the purpose of conducting and supporting marine research. . .advancing scientific knowledge in marine biochemistry, pharmacology, toxicology, nutrition, microbiology. . .bionics and technology, as it may relate to the causes, diagnosis, prevention, treatment and control of physical and mental diseases, and other impairments of man."

Sen. Magnuson added that he is "convinced that a U.S. Institute of Marine Medicine and Pharmacology could make a contribution to world health unexcelled by that of any other nation."

Marine Sanctuaries

On Mar. 20, Sen. Brooke introduced for himself and Sen. Kennedy S. 1592, the Marine Sanctuaries Study Act of 1969. This would authorize the Secretary of the Interior to study the most feasible and desirable means of establishing certain portions of the tidelands, Outer Continental Shelf, seaward areas, and Great Lakes of the U.S. as marine sanctuaries.

Sen. Brooke cited the dangers of uncontrolled exploitation of these areas. He noted that "oil drilling operations which once destroyed fish with their seismic explosions have now been brought under control, but underwater gear and drilling equipment still remain to plague the fishermen with his lines and nets." He also deplored the fact that "landings of fish by U.S. fishermen have remained constant for 30 years, and that this Nation, with one of the most extended coastlines and richest marine resources in the world, accounts for only 4% of the world's fish catch."

New Department of Oceanographic Services

On Mar. 25, Rep. Pepper introduced H.R. 9482, to establish a Department of Oceanographic Services within the cabinet of the President. He said: "To those who might question the advisability of yet another 'bureaucratic department'. . . . Under the present Federal setup relating to maritime and marine interests, there is a total of 11 separate agencies engaged in the marine sciences. This legislation envisions the coordination and consolidation of the major civilian marine functions of the Federal government to accomplish. . .the expansion of exploration of marine environs and the use of marine resources, and development of port and harbor and estuarine areas. . . ."

The new department would have four Assistant Secretaries, one for Marine Fisheries.

Territorial Seas

On Mar. 26, Reps. King, Whalley, and Riegle introduced H.J. Res. Nos. 602, 604, and 606, respectively. These were joint resolutions to declare U.S. policy with respect to its territorial sea.

Rep. Edwards, Ala., introduced H.J. Res. 605 on reciprocity in U.S. territorial waters. Addressing the House, Mr. Edwards said this resolution was designed to stiffen U.S. policy in establishing and enforcing our territorial waters claims and ocean fishing limits.

He proposed that "we should adopt a policy of reciprocity in our territorial waters and fishing limits. . .we would impose on any ship the same territorial and fishing limits which that ship's national government imposes in its own coastal waters."

The resolution also calls for a new international conference to reach agreement by all coastal nations on territorial limits.

--Barbara Lundy

OCEANOGRAPHY

Vast Study of Atlantic East of Barbados Starts in May

The U.S. is cooperating with Barbados in setting up an extensive study of the links between sea and air. The planners say "the mechanism of sea-air interaction is almost unknown, yet it is the primary process which drives the atmosphere's circulation and its weather systems. Unless this process is explored and understood it will be impossible to extend weather prediction to more than a few days."

The project is called BOMEX--Barbados Oceanographic and Meteorological Experiment. It is "the most intensive scientific investigation ever made over a large ocean area."

Area Involved

In May, June, and July 1969, 24 planes, 10 ships, several satellites, 12 buoys--and a vessel that "flips" from horizontal to vertical position--will gather data from the atmosphere and ocean covering 90,000 square miles of the Atlantic east of Barbados; the area stretches vertically from an altitude of 100,000 feet to the sea floor at 18,000 feet. About 1,500 people will take part in data gathering.

BOMEX is the first in a series of large-scale research projects planned by many nations under the Global Atmospheric Research Program (GARP) and directed toward development of a World Weather Watch.

Combined Operation

BOMEX combines the efforts of oceanographic and meteorological communities with 7 Federal departments and independent agencies, 19 universities, and 7 industrial laboratories in the U.S., Canada, and Barbados. For the U.S. Government: Department of Commerce (ESSA); Department of Defense; Interior Department's BCF; Department of Transportation (U.S. Coast Guard); Atomic Energy Commission; NASA; and the National Science Foundation.

BOMEX Objectives

Dr. Joachim P. Kuettner, BOMEX Director, explained the objectives of the BOMEX experiment. He described the air-sea interface as "the scene of a complex and continuous exchange of energy, water, gases, and particulates."

Dr. Kuettner said: "Most of the heat received from the sun is stored in the tropical oceans between the latitudes of 30 degrees North and 30 degrees South, a region representing half the earth's surface.

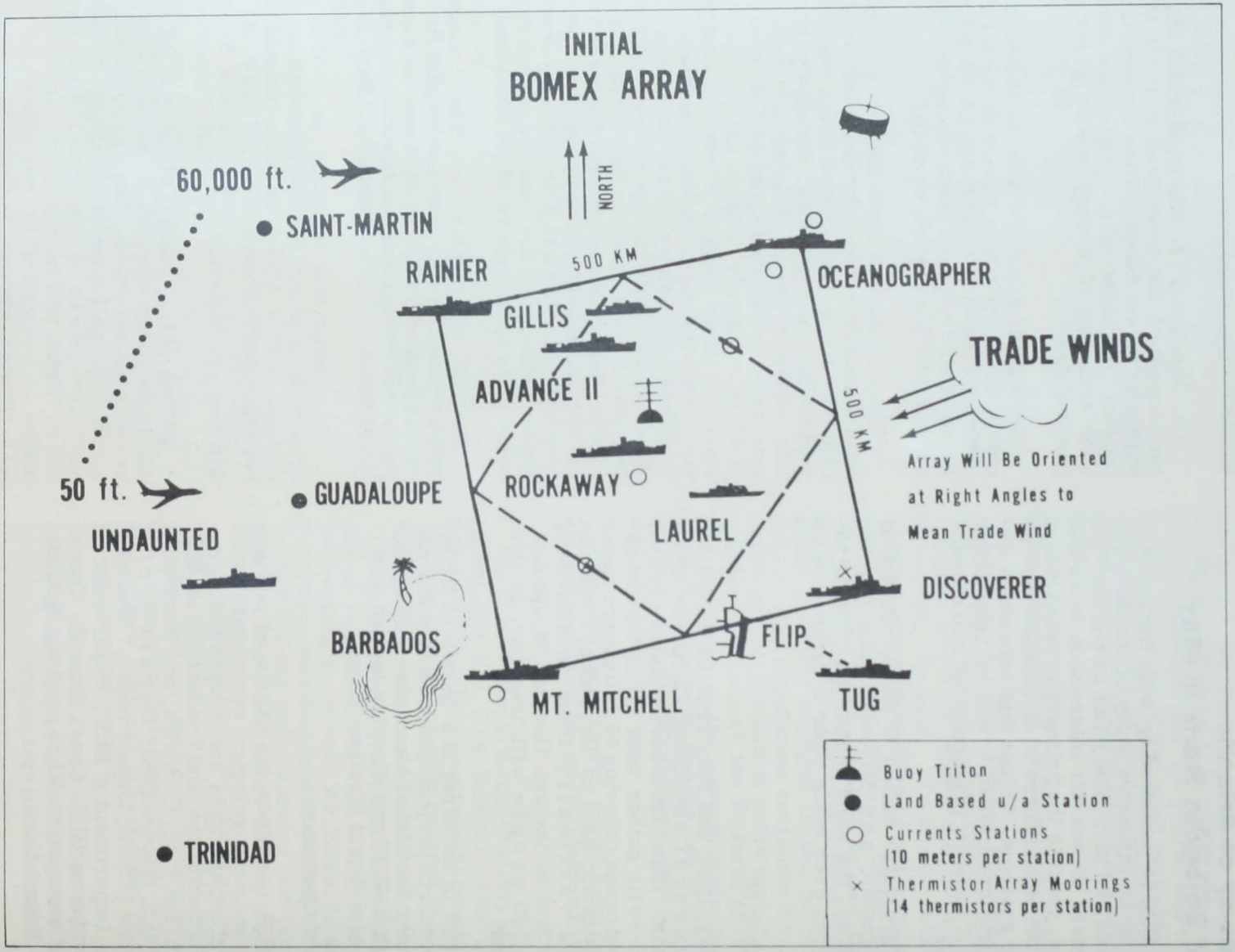
"In contrast, the earth loses heat by radiation almost uniformly at all latitudes, so heat has to be transported from equatorial regions to higher latitudes. Strangely enough, this transport is not done by the ocean, but primarily by the atmosphere. This process, of which relatively little is known, seems to occur in three stages. First, the energy in the ocean transfers to the atmosphere in a turbulent boundary layer about 6,000 feet thick. Most of this energy moves from ocean to air as latent heat in the form of water vapor. Next, the energy finds its way from the boundary layer to the upper layers of the troposphere. Finally, it is transported to higher latitudes by fast-moving air currents, sometimes in the nature of jet streams."

BOMEX will explore the first 2 steps in this process. It will examine in detail "the exchange of energy between ocean and atmosphere, and the vertical and horizontal spreading of these energies within each fluid."

An attempt will be made to predict the area-wide sea-air interactions in a mathematical model based on conventional and satellite observations.

Air Armada in Action

During July, a major study will be conducted by many aircraft to explore tropical weather disturbances. The objective will be to gain information needed to improve mathematical models of the global atmosphere. These flights will be based on continuous photos received at Barbados from NASA's ATS-III (Applications Technology Satellite). The satellite will be moved to a stationary position above Barbados.


INITIAL
BOMEX ARRAY
NORTH
60,000 ft.
SAINT-MARTIN
RAINIER
500 KM
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ADVANCE II
500 KM
Array Will Be Oriented
at Right Angles to
Mean Trade Wind
50 ft.
GUADALOUPE
ROCKAWAY
UNDAUNTED
LAUREL
DISCOVERER
BARBADOS
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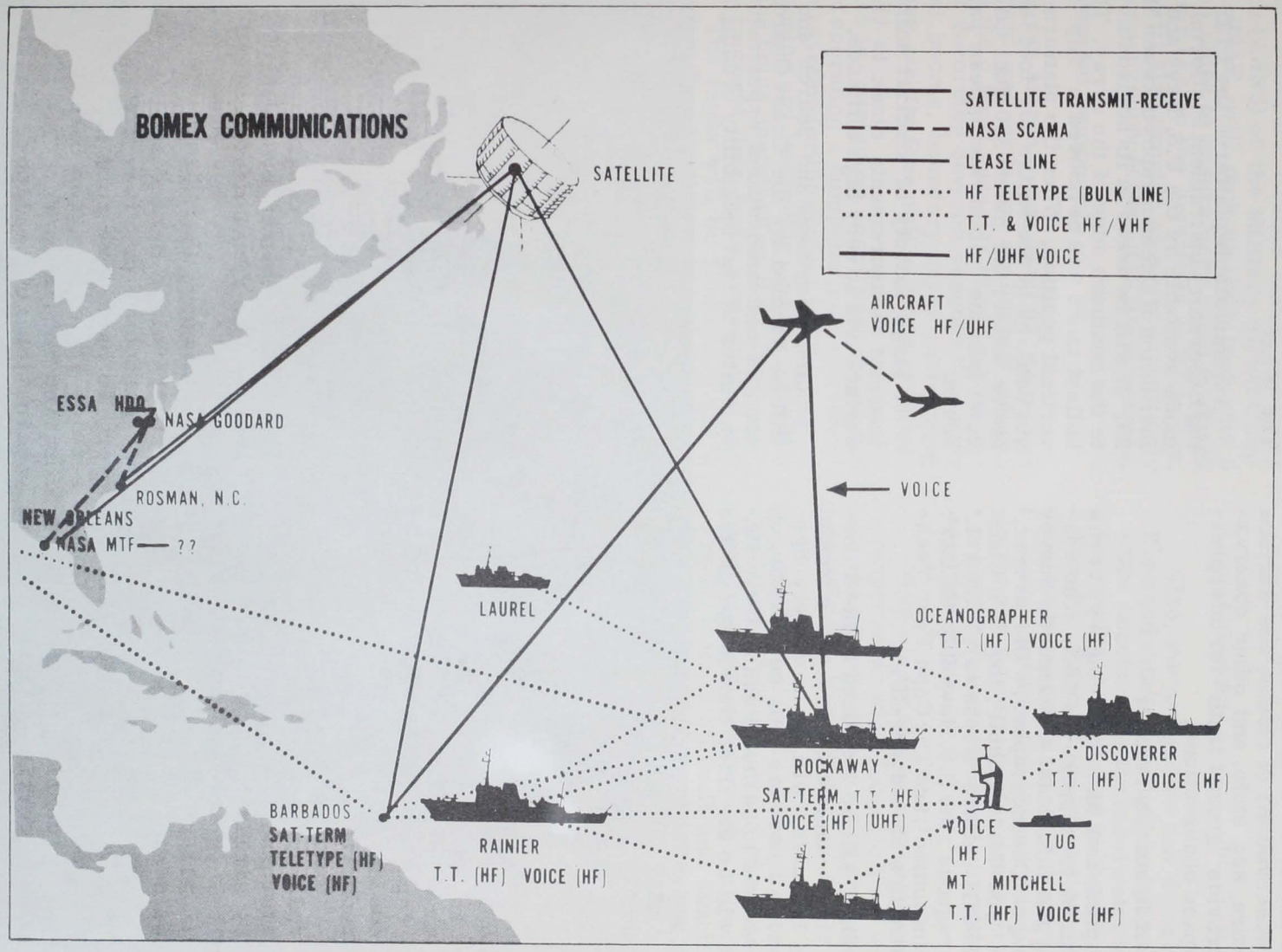
Thermistor Array Moorings
(14 thermistors per station)


BOMEX COMMUNICATIONS
SATELLITE
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NASA SCAMA
LEASE LINE
HF TELETYPE (BULK LINE)
T.T. & VOICE HF/VHF
HF/UHF VOICE
AIRCRAFT
VOICE HF/UHF
ESSA HDQ
NASA GODDARD
ROSMAN, N.C.
NEW ORLEANS
NASA MTF — ??
VOICE
LAUREL
OCEANOGRAPHER
T.T. (HF) VOICE (HF)
ROCKAWAY
SAT-TERM T.T. (HF)
VOICE (HF) (UHF)
DISCOVERER
T.T. (HF) VOICE (HF)
VOICE
(HF)
TUG
BARBADOS
SAT-TERM
TELETYPE (HF)
VOICE (HF)
RAINIER
T.T. (HF) VOICE (HF)
MT. MITCHELL
T.T. (HF) VOICE (HF)

Data from 5 ESSA satellites and 2 Nimbus satellites will be used to provide photos of the cloud cover. Several aircraft will obtain detailed observations of clouds, sea-surface temperature, sea state, and other observations to provide "ground truth" for interpreting the space observations.

Armada of Research Vessels

Many platforms and observing systems are required to support BOMEX. The vessels are: the U.S. Coast and Geodetic Survey (CGS) ships 'Oceanographer,' 'Discoverer,' 'Rainier,' and 'Mt. Mitchell'; the U.S. Coast Guard (USCG) cutters 'Rockaway,' 'Laurel,' and 'Courageous'; the U.S. Navy Ship 'Gilliss'; BCF's 'Undaunted'; and The Cape Fear Technical Institute's SS 'AdvanceII'.

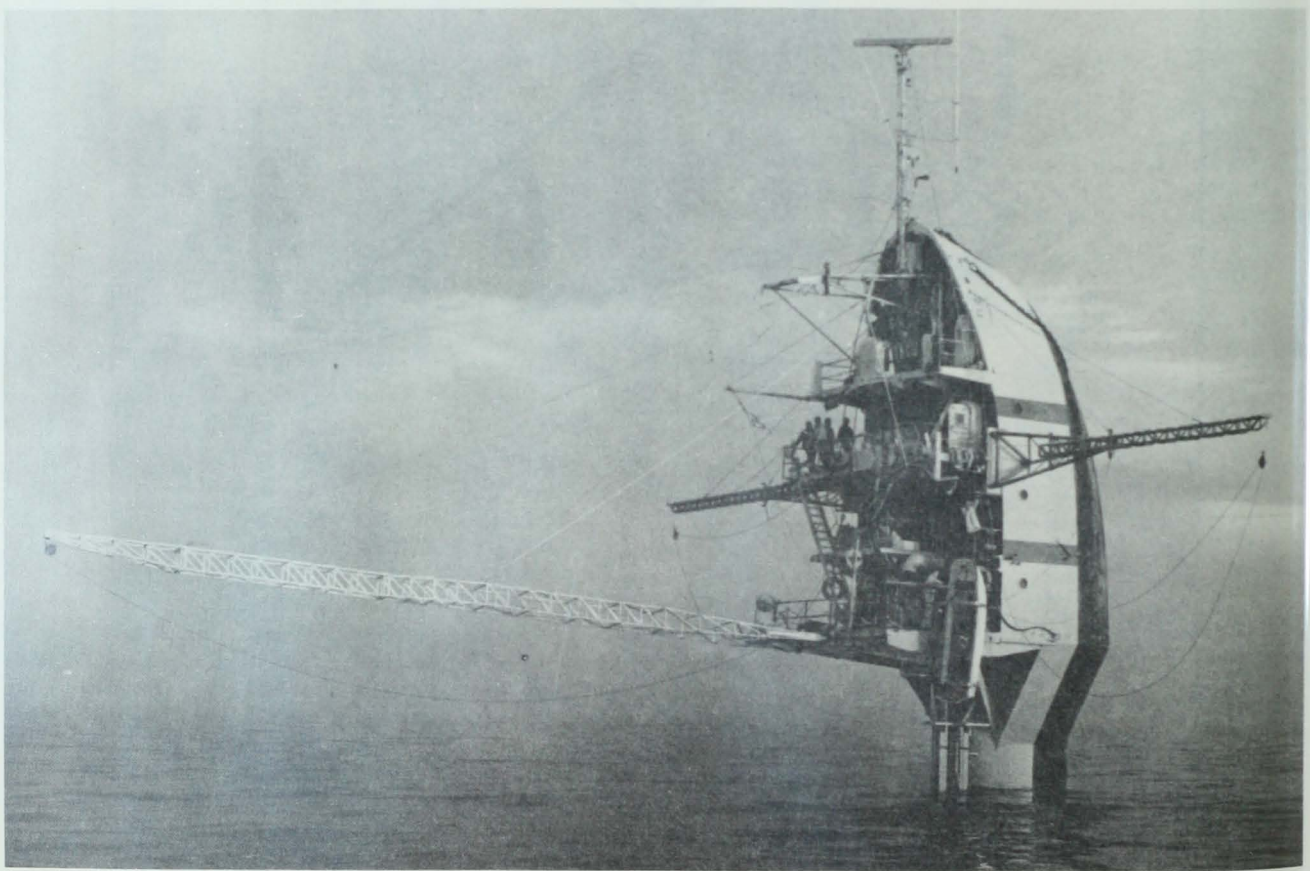
CGS ships will be stationed at the 4 corners of the 5-degree-square experimental area; the Rockaway will be in center. Special mooring systems will be installed on these 5 vessels to anchor them at their stations. It will be the first time ships of this size will be anchored in 18,000 feet for such long periods.

The 'FLIP'

A unique stable platform, the FLIP (Floating Laboratory Instrument Platform), is being made available by the U.S. Navy and Scripps Institution of Oceanography between May 2 and 29. It will be towed in its horizontal position to the southern edge of the array. There, its ballast tanks will be flooded to "flip" it to the vertical position. When the platform is fully vertical, 55 of the entire 355-foot length are above water; the other 300 feet extend well down into the "silent, motionless part of the ocean."

A large variety of aircraft will provide frequent measurements close to the ocean surface and at very high altitudes.

Communications and Search and Rescue will be handled by the Coast Guard. It will conduct communications experiments using satellites to test feasibility of using satellite



'FLIP' in flipped position. (Official U.S. Navy Photo)

communications for future activities similar to BOMEX.

The Aerospace Rescue and Recovery Service (ARRS) of the Military Airlift Command, USAF, will pick up data from the 5 moored ships to ensure very rapid feedback of samples to the scientists at Barbados. ARRS will also provide emergency resupply and recovery support for all BOMEX vessels.

Sophisticated Equipment

Between March 3 and April 23, special equipment was installed at Gulfport, Miss., aboard the 5 fixed vessels: Signal conditioning and recording devices, sensors, meteorological booms, boundary layer instrument packages, and the free-fall mooring systems.

NASA is "designing, installing, maintaining, and operating a computerized data-management system for the project." Five Signal Conditioning and Recording Device (SCARD) units are being installed on the 5 fixed vessels to record data from atmosphere and ocean. The tapes will be flown to NASA's Mississippi Test Facility to be processed and reduced. This will provide a "quick look" to the BOMEX Director to establish data validity and enable him to modify the observation program if necessary. The data will become part of BOMEX's master data file.

ESSA is the lead U.S. agency for the experiment. It is the U.S. Cooperating Agency with Barbados. The Barbados Cooperating Agency is the Ministry of Home Affairs.

Bathymetric Charts Guide Mariners

Bathymetric charts showing the sea floor's diversified topography are among the most valuable navigational guides available to Navy and civilian mariners, believes the U.S. Naval Oceanographic Office (NOO). The charts also may lead toward more effective use of the sea. The NOO-produced charts result from scientific interpretation of sounding data collected by military and merchant ships.

After evaluating these data for accuracy, the charting specialists plot the 'best' information. From it, they draw depth contours to show submarine mountains, ridges, canyons, valleys, and trenches. (See charts and sketch.) Then, navigators using advanced echo-sounding equipment can use the charts to guide their ships "from seamount to escarpment to ridge in the open ocean."

Chart's Uses

Also, the navigators can determine positions and obtain running fixes by locating their ships in relation to the underwater topographical features shown on bathymetric charts. The charts also aid geophysicists, geologists, and oceanographers studying the oceans. Charts can assist military and civilian planners to prepare for routing submarine cables and selecting sites to install equipment and facilities.

NOO states that each bathymetric chart comprises an area "equal to Utah and Nevada combined, with a topography that may be equally as diversified."

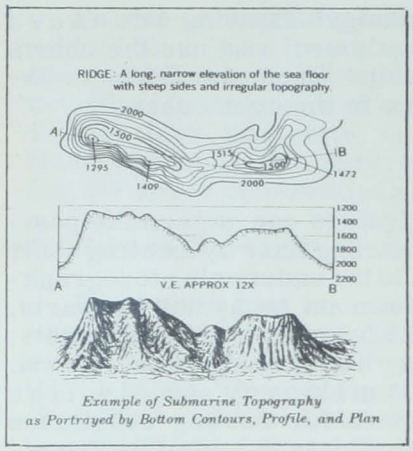
Water conceals the ocean floor, so contours developed from soundings of submarine geographical features for such a large area "represent a most difficult and exacting task." The operation is like charting the mountains and valleys of Utah and Nevada from contours based on elevation readings taken 5 to 10 miles apart with a spacing of 2 to 50 miles.

Charting Ocean Topography

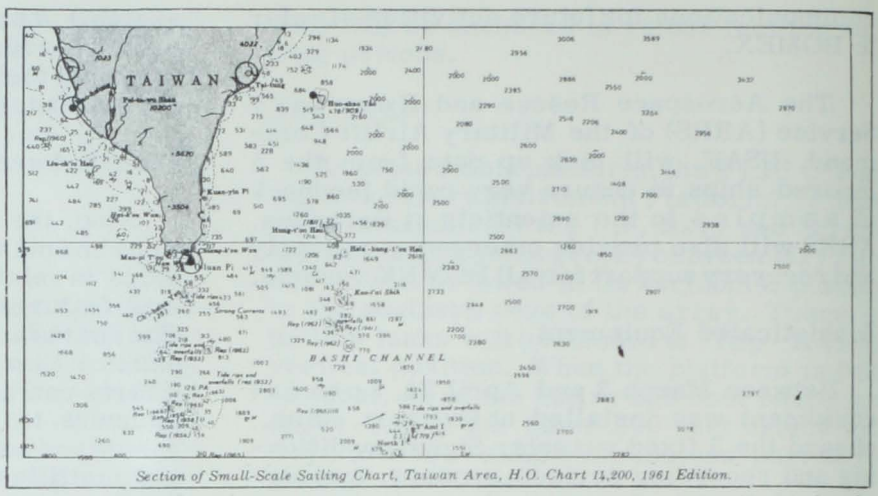
Soundings--measurements of water depth beneath the ship--are taken at intervals by depth recorders. The soundings give an idea of deep and shallow points. Specialists review these points carefully to determine submarine mountain ranges, ridges, valleys, etc.

However, even the slightest difference in positions of 2 independent observers working from unstable platforms at different times could result in error. "One (observer) could actually be looking at the elevation of a peak, while the other was inspecting the elevation in a valley or basin."

NOO points out that although absolute accuracy "can never be achieved by this means, the trained geologist or bathymetrist can interpret the combined observed data, including that collected on planned hydrographic surveys and that obtained along 'random tracks'--the courses taken by civilian and military ships on merchant routes or on operations--and come up with a reasonable portrayal of the true land forms."



Example of Submarine Topography as Portrayed by Bottom Contours, Profile, and Plan



Section of Small-Scale Sailing Chart, Taiwan Area, H.O. Chart 14,200, 1961 Edition.

Section of BC Chart 2404, Taiwan Area (Reduced), 1962 Edition.

BATHYMETRIC CHART SHOWS OCEAN FLOOR--Bathymetric charts, such as one just above, are contoured to show ocean floor's topography. The contours result from interpretation of countless soundings and can produce drawing of a submarine mountain (upper left). A standard sailing chart (upper right) shows noninterpreted soundings. Charts, with their contours, give mariner 100% information on sea floor, while standard sailing chart, showing only selected soundings, gives about 2% data.

Evaluating Method

The charting specialists must evaluate the method in obtaining data. They must know type of echo sounder, kind of navigational control used, how tracks were adjusted to navigational position fixes, and frequency of fixes.

Sounding Data Sometimes Distorted

Sounding data can be distorted by 'phasing,' the Deep Scattering Layer (DSL), and interference.

Phasing, NOO explains, "is a recording phenomenon that occurs when the distance from the keel of the ship to the bottom is greater than the scale of the depth recorder used." This occurs when the operator of sounding equipment uses a shallow-scale recorder, such as one with a 600-fathom maximum, in deeper waters.

The DSL, a marine life phenomenon, also can cause operators of depth sounders to report shallow areas where, in fact, the ocean

floor is much deeper. The Layer is composed of fish and other small marine organisms. They shun light and rise to surface to feed at night and on dark, cloudy days. They sink into sea's depths at sunrise on bright days. Today's deep-sea sounders can, with good acoustic conditions, observe both DSL and true sea floor. But use of shallow-water echo sounders can result in misinterpretation of the DSL as true sea floor.

Interference results from the transmission of 2 or more sound waves on the same or different ships in the vicinity. When 2 echo sounders run simultaneously, the transmitted pulse "is generally so strong that it is recorded on the other echo sounder, even if the frequencies are different." The result is that the pulse can be interpreted as a measurement, when actually it is a direct wave from the other sounder.

Doubtful Features Charted

Despite meticulous interpretation, the specialists know that all their depth measurements are not accurate. So they will chart a 'doubtful' topographical feature in the interest of safe navigation and not remove it until its existence can be disproved.

This can be done because the bathymetric chart--a contoured map, not one showing thousands of numbers to indicate depths--allows specialists to use all sounding data instead of the 2% shown on standard sailing charts.

NOO concludes: "Continued emphasis on oceanographic programs, including modest but precise survey efforts to fill voids and resolve discrepancies in existing bathymetric data holdings, will not only result in better charts for the navigator but probably is the essential first step toward reaching the goal of 'a more effective use of the sea.'"

Camera Mounted on Diving Vehicle Saves Oceanographers Time

An underwater camera mounted on a Pegasus diving vehicle speeds bottom surveying so much that oceanographers of the U.S. Naval Oceanographic Office (NOO) believe the technique will greatly extend the capabilities of divers.

Chet Bright, who heads the NOO diver-oceanographer group, recently completed a bottom study in the south part of Biscayne Bay, Florida. He reported that divers using a motion-picture camera aboard Pegasus spent about 3 hours in diving time to obtain continuous bottom photographs of a 30-foot by 10-mile track. Bright said: "This is indeed speedy surveying when you consider the tremendous amount of bottom covered. A diver, using conventional swimming techniques, would have to spend weeks covering the same area."

Project SPOC

NOO scientists are working on Project SPOC, a cooperative spacecraft oceanography venture with the University of Miami as part of NASA's Earth Resources Program. They are comparing the photos taken by the divers with those snapped from a NASA aircraft.

The scientists are using the divers' photos as an accuracy base to demonstrate feasibility of observing marine life and charting underwater features in coastal waters through aerial and, eventually, satellite photography.

Biscayne Bay Survey

During the Biscayne Bay survey, one diver-oceanographer in the 3-man team not only operated the camera down to about 3 feet off bottom--but also controlled vehicle along survey track. (See photograph.)

(Photo: James B. Sweeney)

"The controls for the Pegasus are much like those in an airplane," Bright explained. The vehicle, equipped with all instruments necessary to maintain course, also carried floodlights to light area being photographed, and depth sounders to tell diver how far he was from bottom.

The underwater 16 mm. camera is capable of snapping 500 frames per second. To insure accuracy, the oceanographers slowed it to 16 frames per second. The camera is encased in fiberglass and can operate at depths of 300 feet. "Its pictures bring the bottom up to us," Bright stated.

Bright believes that putting a camera aboard a Pegasus vehicle not only will speed bottom surveying, but it also will be useful in "any type of fine grain operation," including checks on underwater cables and geological and biological studies.

Nation's First Estuarine Prediction Service in Maine to be Evaluated

The Nation's first estuarine prediction service, in Maine's Penobscot River and Bay estuary, will be evaluated beginning in April by ESSA's Coast and Geodetic Survey (CGS) to determine its effectiveness.

The service was launched in May 1968 as a one-year pilot program. The Government hopes it will develop into an important service for Government and private agencies in pollution control.

The evaluation will include a circulatory study of the entire Penobscot River and Bay Estuary by the 'Ferrel.' The 133-foot, 289-ton ship is the first to be built in the U.S. specifically to determine circulatory patterns of tidal currents. The study will continue into October 1969. It will also provide more accurate navigational services to yachting, fishing and commercial interests. It will be the first extensive one ever made of the tidal currents in this area.

The survey will help determine how accurate predictions have been in the past year, and provide more data to improve service.

The Prediction Service

Under the estuarine prediction service, advance forecasts are issued twice monthly on the rate possible pollutants pass through the estuary. The forecasts are made by CGS and the Weather Bureau, which furnishes the necessary river discharge forecast and advisory information.

C. R. Muirhead of CGS said the service can be of 'tremendous importance potentially' to commercial and sport fisheries, wildlife conservation and, during the summer months, to recreational activities, especially swimming and boating. "If fully utilized," he added, "this service could enable state and local authorities to institute possible remedial measures to reduce the rate at which potential pollutants are being added to the water."

Survey N. Carolina Seabed

The first detailed large-scale survey of the seabed off the Atlantic Coast between Hatteras and Cape Fear, North Carolina (N.C.), is underway, reports the Coast and Geodetic Survey (CGS).

The 5,000-square-mile survey is being conducted by the 'Peirce,' based at Morehead City, N.C., until May 1969. It will be continued by the 'Mt. Mitchell' from August to October. The survey data will be used for a new bathymetric map of the continental shelf from Wilmington, N.C., to Hatteras, N.C., to be issued within the next 2 years.

Part of Program

The bathymetric survey is part of a long-range program begun off the Atlantic Coast in 1967. The program's purpose is to provide detailed maps of the entire continental shelf, which extends from the shore to a depth of about 600 feet. These maps delineate the sea-floor contours and aid Federal, State, and industrial interests in exploring and developing its vast potential resources.

The Peirce will survey the sea bottom from Cape Lookout to Cape Fear, to the edge of the shelf, while the Mt. Mitchell will work the Cape Lookout-to-Hatteras area.

The Operation

The last bathymetric surveys in this area were made over 40 years ago. These provide general information of the sea bottom for vessels approaching the more shallow areas close to shore. During the current survey, the ships will survey the seabed in detail from 60 feet to the shelf edge. They will determine, for the first time, the detailed configuration of underwater valleys, plains, and

ridges. Existing CGS survey information of shallow waters also will be used for the map. The new data will be incorporated in existing nautical charts of the deep waters.

The hydrographers will use an echo sounder to measure and record depths. These will be determined by the time required for a sound wave produced in the vessel's hull to reach bottom and for its echo to return. The return echo is recorded on a permanent graph at rapid intervals. These form a continuous profile of the sea floor below the moving vessel. The ship's position during surveying will be obtained by an electronic positioning system.

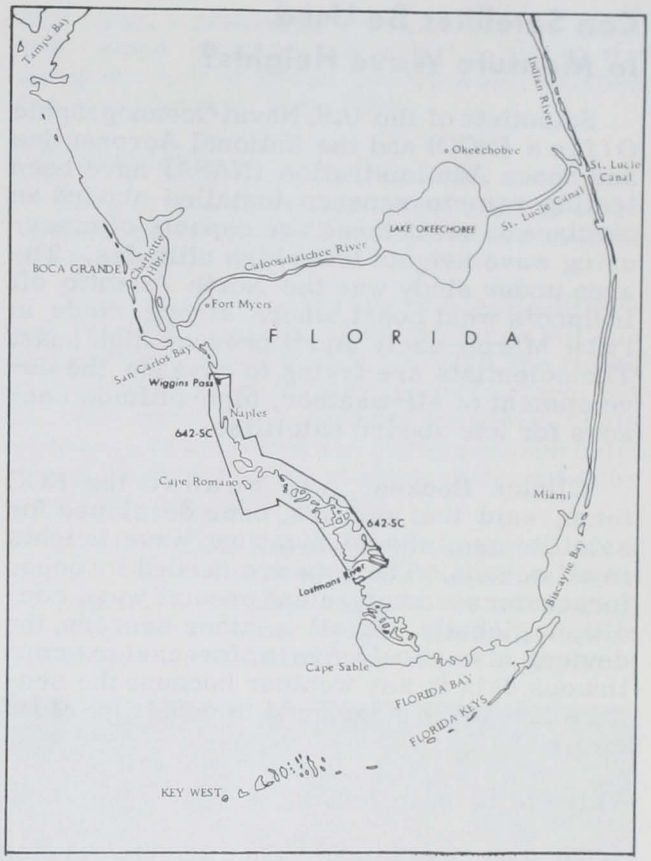
Chart 'Fishermen's Paradise' in Everglades National Park

The Coast and Geodetic Survey has published a new nautical chart that covers in detail a "fisherman's paradise" in a key part of the Everglades National Park.

The area is a favorite for fishermen from south Florida and from hundreds of miles around. Before, fishermen faced the danger of getting lost within minutes in the maze of twisting waterways that cover the subtropical area. The new large-scale chart (1:40,000) will provide the extra detail required to navigate safely.

Area Covered

The accordion-folded, small-craft chart (642-SC) can be readily unfolded in the cockpits of recreational boats. It covers the park's northwest section along the southwest coast of Florida, from Lostmans River to Wiggins Pass, and thousands of mangrove islands offshore. Lostmans River is about 70 miles northeast of Key West, and Wiggins Pass is about 25 miles south of Fort Myers.



'Fishermen's Paradise' in Everglades National Park covered by new nautical chart issued by the Coast and Geodetic Survey.

Color and infrared photography was used to depict the many islands, lakes, and natural channels in this relatively uncharted wilderness area.

The new chart is expected to increase the park's recreational value. Each year nearly 850,000 people visit it. The park contains about 365,700 acres of water surface and over 1,000 miles of rivers and streams.

The chart may be purchased for $1.50 from Coast and Geodetic Survey nautical chart agents, or from Coast and Geodetic Survey (C44), Rockville, Md. 20852.

Can Satellites Be Used to Measure Wave Heights?

Scientists of the U.S. Naval Oceanographic Office (NOO) and the National Aeronautics and Space Administration (NASA) have been testing remote sensors installed aboard an airplane to see if these are capable of measuring wave heights from high altitudes. The area under study was the North Atlantic off Ireland's west coast, where strong winds in late March-early April produce high seas. The scientists are trying to advance the development of all-weather, high-altitude sensors for use aboard satellites.

Clinton Beckner, who headed the NOO team, said that sensors, once developed for satellite use, should measure wave heights in all oceans. The data are needed by ocean forecasters to analyze and predict wave conditions globally. As all-weather sensors, the devices also should give the forecasters continuous data in any weather because the sensors are being designed to penetrate cloud cover.

Value of Remote Sensing

Beckner explained: "Such remote sensing capabilities would make for inexpensive forecasting because the cost of orbiting a satellite is less than that of deploying and maintaining several aircraft that would be needed to provide similar, world-wide coverage." He added that inexpensive and rapid forecasting of wave conditions would have a "tremendous impact" on naval, shipping and fishing operations, and scientific activities. "The Navy, like everyone who uses the seas, could operate in the oceans more effectively if Navy men have a better idea of what wave conditions are going to be in any area of operations." Scientists could learn more about wave growth and decay by studying the wave height data provided on a world basis by satellite sensors.

What Scientists Seek

The scientists are interested primarily in determining if they can record wave heights in heavy seas (more than 18 feet). They learned earlier, in March 1966 near Bermuda, and in April 1968 off Ireland's east coast that the high-altitude sensors can measure wave heights in moderate and low seas.

They installed the sensors--a microwave radiometer and a radar scattometer--in a NASA test airplane. A second plane, a Super Constellation assigned to NOO, was equipped with laser and radar wave profilers. These instruments give reasonably accurate readings from altitudes of 500 to 1,000 feet, but they are not designed to record wave heights from high altitudes.

Both planes took off from Shannon, Ireland, when observers aboard 3 European weather ships stationed 400 miles apart off Ireland reported heavy seas. The NASA plane flew at 20,000 to 50,000 feet, and the NOO plane at 500 to 1,000 feet. On each run, the planes logged 1,200 miles--400 miles from Shannon to the first weather ship, 400 miles to the second, and 400 miles back to Shannon. There, the scientists compared remote sensors' readings with those recorded aboard the NOO plane--and with on-the-spot measuring devices aboard the 3 weather ships.

What's Ahead

Beckner concluded: "If at the end of the five scheduled runs we find that the readings from the remote sensors compare favorably with those taken both by the instruments aboard the low-level Oceanographic Office plane and by the ships' devices, we will know that the sensors, too, can measure wave conditions in heavy seas from altitudes of 20,000 to 50,000 feet.

"Then at a later date, we will try the sensors aboard high-flying aircraft at even higher altitudes and will again fly them over low moderate and heavy seas. If they record wave heights in the three types of seas at these still higher altitudes, we will be ready to test them on a satellite."

Foreign Fishing Off U.S. in February 1969

NORTHWEST ATLANTIC

Bad weather and severe snowstorms hampered surveillance in February. However, 182 individual fishing and support vessels from the USSR, Poland, and Japan were sighted, considerably more than the 70 seen in January.

Soviet vessels increased from about 50 early in the month to about 150 by the end. In Feb. 1968, only 53 Soviet vessels were sighted between Nantucket and the Virginia Capes. Twenty-one Polish and 2 Japanese vessels were seen in Feb. 1969.

Off Southern New England

About 15 Soviet factory stern trawlers were sighted south of Nantucket to south of Block Island, R.I., in ICNAF Sub-area 5, just beyond the eastern boundary of the 'no fishing' zone. Catches were primarily red hake, with some herring and whiting. About the same number of Soviet stern trawlers fished the same area in Feb. 1968.

Off Midatlantic

Soviet: The fleet increased from 25 to 50 vessels in Jan., and 60 more arrived in first week of Feb.

This year's fishing pattern is quite different from last year's, when the large buildup did not begin until March. In 1968, the fleets were mainly large factory stern trawlers, but in 1969 most were medium trawlers. This change in vessel-type and fishing season indicates the Soviets are seeking different species this year than in 1968.

In early Feb., 50 medium trawlers and 3 'Slava' class processing motherships were spread in an irregular line 70-80 miles long off southern New Jersey, from Barnagat Lightship to south of Cape May. Equipment

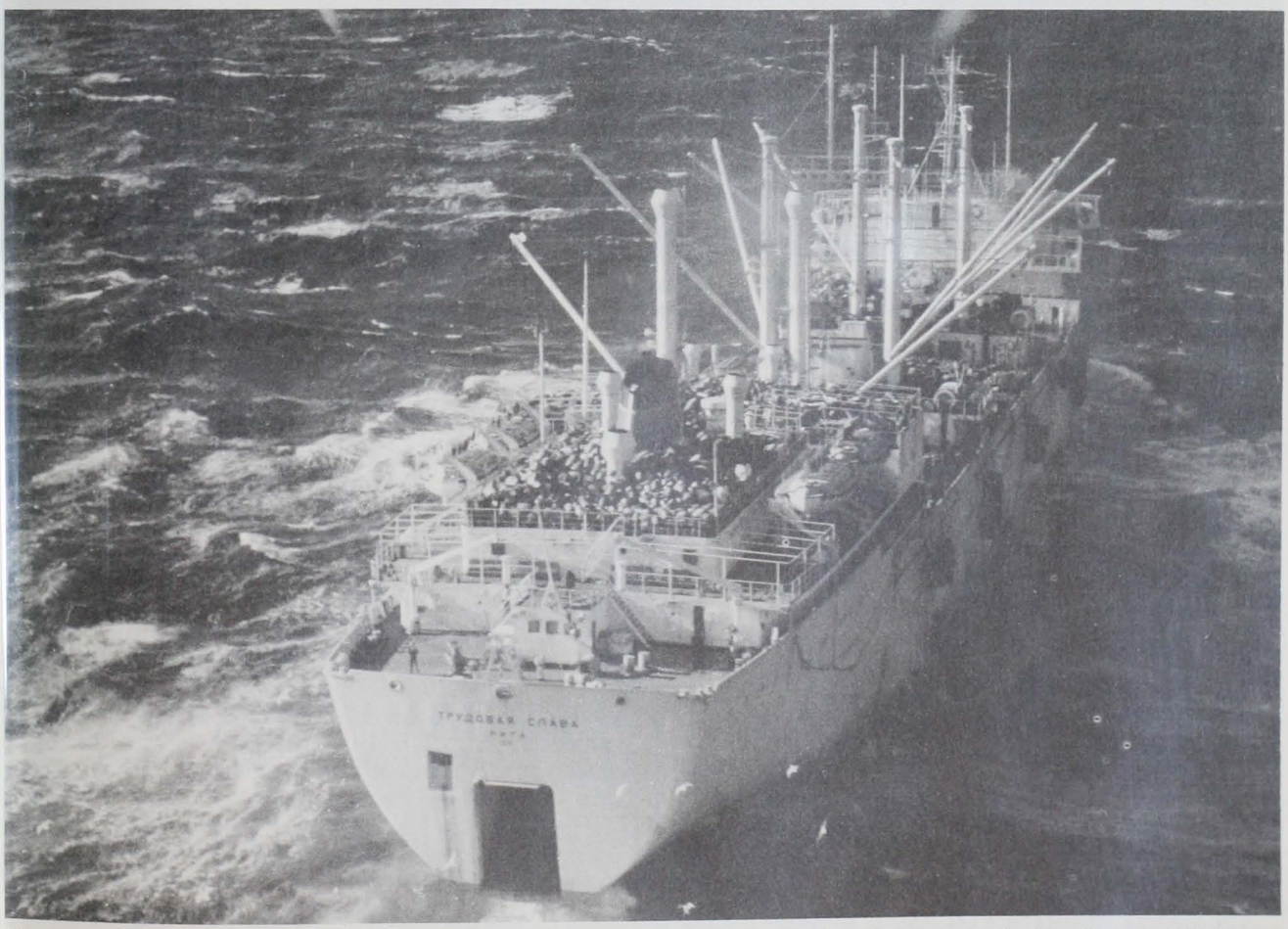


Fig. 1 - Empty barrels (on platform above stern) will be used to store salted herring in the refrigerated holds of the base ship 'Trudovaya Slava,' built in West Germany in 1967. (U.S. Coast Guard)

on all vessels was lashed down, decks were awash, and the fleet seemed to be weathering out a storm rather than fishing. No catches were observed.

Moving south toward the Virginia Capes, this fleet was joined by enough other vessels to double its size. By the second week in Feb., 112 fishing and support vessels had been sighted.

off Currituck, N.C. By Feb. 25, the fleet off New Jersey had joined the Currituck fleet off Cape Hatteras, where Soviet exploratory vessels had discovered large herring schools.

Polish: In early Feb., about 12 vessels supported by a mothership, the 'Pomorze,' fished in the Mid-Atlantic Bight. Although operating independently, Polish fishermen kept close to the Soviet fleet, which supplies

Fig. 2 - With a side-trawler nestled alongside, the Polish base ship Pomorze supports the fleet fishing herring off the coast of Virginia. The photo was taken from a U.S. Coast Guard surveillance plane on February 8, 1969. (U.S. Coast Guard)

Eighty-nine were seen about 50 miles east of Norfolk, Va., in a 35-mile-long area from Cape Charles to south of Cape Henry. Another 7 trawlers fished herring about 40 miles east of Chincoteague Island, Va. Moderate catches were seen on decks. Eleven other trawlers fished herring east of Cape May, N.J. A few vessels scattered between these groups were probably in transit or searching for fish schools. The groups, mostly medium trawlers, were supported by 5 modern processing motherships. Two stern factory trawlers sighted off Norfolk might have been doing exploratory fishing. Moderate-to-excellent hauls of sea herring were observed.

After midmonth, 69 Soviet vessels, including 10 support vessels, were sighted off Fire Inlet, N.Y., and as far south as Atlantic City, N.J. Most were fishing in 15-20 fathoms, 20-30 miles offshore. Moderate catches appeared to be herring; 1 stern trawler fished red hake. About 35 vessels fished

them with fishery intelligence--location of fish schools, information on fishing grounds, weather reports--and sometimes supplies, water, and fuel.

Early in the month, 3 trawlers were sighted huddled together riding out a storm about 40 miles off Cape May. On Feb. 13, 12 trawlers, with 7 Soviet trawlers, fished 40 miles east of Chincoteague. By the 20th, 13 Polish trawlers were scattered among a large group of about 70 Soviet vessels, from south of Long Island to east of Atlantic City. All Polish vessels were side trawlers, except for 1 stern trawler. Catches on side trawlers were herring; no catches were seen on the stern trawler.

Japanese: Two stern trawlers were sighted. On Feb. 4, 1 was sighted 65 miles southeast of Cape May, and on Feb. 20, 2 were seen in the Hudson Canyon area. Each time they were in the U.S.-USSR 'no fishing'

one. No catches were noted. Representations have been made to the Japanese Government concerning abstention of fishing in this zone. The Japanese press reports that about 9 vessels will continue 'exploratory' fishing in the area during 1969.

.S.-USSR Midatlantic Agreement

No Soviet vessels were observed in the o fishing' zone. Only 2 were seen in the ong Island loading and unloading zone.

iolations of U.S. Fishing Limits

On Feb. 8, 20 foreign fishing vessels were ighted inside the 9-mile contiguous zone. leven Polish and 4 Soviet vessels had fishng gear in the water. By the time a Coast uard patrol arrived, all the vessels had oved beyond the 12-mile limit. The Polish leet commander aboard Pomorze was arned that a repetition of the offense would esult in seizure of the violating vessels. A ew days later, most of the Soviet fleet had oved 40-50 miles offshore.

ULF OF MEXICO & SOUTH ATLANTIC

No foreign fishing vessels were reported.

FF CALIFORNIA

No foreign vessels were observed fishing Feb. The last report of foreign fishing ere was in Nov. 1968.

OFF PACIFIC NORTHWEST

Japanese: One longliner was sighted; no catches were observed. In Feb. 1968, 7 vessels, including 2 long-liners, were seen in the area.

Soviet: The first fishing vessel sighted in 1969 was a side trawler off Cape Flattery, Wash., in the second week of Feb. Fishing off Oregon in the third week, it was joined by another side trawler, and by a stern trawler in the fourth. In Feb. 1968, 13 vessels were sighted.

OFF ALASKA

Soviet: Vessels increased from 130 in late Jan. to 160 in Feb. The growth was in the flounder and groundfish fleets in the eastern Bering Sea. About 100 vessels were sighted in Feb. 1968.

The eastern Bering Sea flounder fishery followed the pattern of previous years, when vessels increased from 50 to 70 during Feb. At month's end, there were 25 factory trawlers, 30 medium trawlers, 13 factory vessels and refrigerated transports, and 2 support vessels.

The herring fleet--about 25 factory trawlers, 30 medium trawlers, 12 factory and refrigerated transport vessels and 3 support vessels--remained northwest of the Pribilofs in central Bering Sea throughout Feb.

- 3 - The 571-foot long Soviet base or factory ship 'Spassk' nested with a tanker (visible in picture) and a refrigerated transport, a tern trawler, and a tug (only masts shown in picture) in ice pack in central Bering Sea. These ships are part of the approximately D-vessel winter herring expedition off Alaska. (J. Branson)

Twelve medium trawlers fishing groundfish--primarily arrowtooth flounder and sablefish--off the Continental Shelf edge, north of the Aleutians in the eastern Bering Sea, were joined by 6 more medium trawlers. The latter fished in shallower waters, primarily catching Alaska pollock. Two refrigerated processing transports supported them.

Japanese: The fleet, about 40 vessels in late Jan., decreased to about 30 by end of Feb. This was about 25 fewer than in Feb. 1968.

Four stern trawlers fished ocean perch in the Gulf of Alaska during first half of the month; only 2 remained at the end. Four stern trawlers fished ocean perch along the Continental Shelf in eastern Bering Sea through the month.

Six trawlers, one factoryship, and 1 reefer fished flatfish and Alaska pollock in eastern Bering Sea. At least 2 factoryships en route from Japan were expected to increase effort in this fishery in early March.

The herring fishery northwest of the Pribilofs (close to the Soviet herring fishery) continued through the month, with 10 stern trawlers, 2 medium trawlers, and one factoryship.

Six to 8 longliners fished sablefish in the Gulf of Alaska during first 3 weeks. Effort began to decline during the last week and, by month's end, only 1 or 2 vessels remained.

IMPROVING UNDERWATER EXPLOSIONS

The vibrations produced by controlled underwater explosions are useful in such diverse tasks as prospecting for oil and developing new underwater communications systems.

Just dropping a few bombs over the side, however, won't do the trick, especially for the prospectors, who need extremely precise shock waves to examine soil and rock strata beneath the water. The trouble is that a charge set off at great depth or near the bottom creates a large bubble at the moment of explosion. This bubble pulsates as it rises to the surface, with an action similar to that of a taut spring which is suddenly released. The pulsations in turn cause secondary disturbances which interfere with the recording of the main shock wave.

One way around this is to put the explosive charge in a perforated sphere, which causes the bubble to break up into smaller bubbles that do not disturb the seismic recordings. This, however, poses the problem of reloading the sphere somehow when a series of successive explosions are necessary, as is often the case. Recently, two approaches to the problem have been patented--one from France and the other from the U. S.

The French method is simply to trail the perforated sphere from the end of a long tube leading to the deck of a ship. The explosive charges are dropped down the tube and set off with timers or depth sensors. One variation is to pour explosive ingredients down the tube to the sphere, then set them off with electrodes.

The American approach does away with the perforated sphere. Instead, a highly-conductive liquid is poured into the water between a pair of electrodes, which vaporize it into a superhot plasma. This forms a huge bubble of hot steam which then collapses to produce shock waves that are predominantly low-frequency. The increased low-frequency content helps obtain data from as far as several miles below the water bottom. (Reprinted with permission from "Science News," weekly summary of current science, copyrighted 1966 by Science Service, Inc.)

ATES

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H & GAME DEPT. ISSUES
8 ANNUAL REPORT

The 1968 annual report of California's De-rtment of Fish and Game, which appears in tdoor California' March/April 1969, re-cts the Department's extensive activities he fisheries. Here are some highlights:

I. INLAND FISHERIES

In 1967-68, its fish hatcheries "produced ,248,896 resident, anadromous, and warm-ter fish weighing a record 2,705,759 unds." Of this total, 25,384,457 were trout d kokanee, 13,604,310 salmon and steel-ad, and 260,129 warmwater fish.

The Department planted 900 back country es by air with 6 million fingerling trout. was this program's 20th year. Aerial plant-g "has reduced the cost of planting from 3.75 to $1.43 per thousand fish."

The proposed warmwater hatchery site in perial Valley was tested successfully. The partment will build this facility to raise 0,000 one-half-pound channel catfish a year stock southern California waters.

Proceeding on schedule is construction of $2.2 million Mad River Salmon and Steel-d Hatchery. It will be completed this year produce 1,000,000 yearling and 5,000,000 gerling salmon and steelhead to stock north st streams.

uable Research Information

The annual report states that several re-rch projects have produced valuable in-rmation on fishery management. For ex-ple:

"The Salton Sea study disclosed that a linity of about 40 parts per thousand is the ximum tolerated by eggs and young fish. is means that the increasing salinity of the a must be controlled before it reaches this el, to protect the great fishery there."

Sturgeon tagging will enable the Depart-nt to closely watch the rising catch of rgeon and determine management needs.

A large striped bass tagging program is expected to gain information on the "total population, recruitment, harvest, and natural mortality of this fish."

A coldwater reservoir study "determined the optimum size and strain of trout fingerlings and the best time to plant for maximum returns." This will enable biologists to provide better trout fishing at lower cost.

II. MARINE RESOURCES

The 1968 commercial fish catch was expected to drop 10% from 1967 landings of 503 million pounds. This would reflect lack of anchovy fishery during early 1968 and drop in skipjack landings from 1967's high level. "Tuna landings account for over half the catch, as is the usual case."

Eight Department-tagged bluefin were recovered off Japan--and 2 Japanese-tagged bluefin off California. "This indicates Japanese and America fishermen are harvesting the same stocks."

"The crab resource appears to be coming back in the San Francisco area and is healthy off the North Coast."

Estimates of the shrimp population were high enough to permit a quota increase from $1\frac{1}{2}$ to 2 million pounds during 1968.

Exploration for prawns showed populations large enough "to support moderate fisheries off Monterey and Catalina."

Anchovies

During last season, the reduction fishery landed "only 6,500 tons of anchovies," nearly all from Monterey Bay. "Low landings were due chiefly to adverse economic conditions and the failure of commercial size schools to form in near-shore waters."

Since March 1966, 369,300 anchovies were tagged, 178,700 in 1968; 755 tags were recovered, 240 in 1968.

Live Bait

Reported live bait landings were expected to reach a record 7,000 tons. This is

"primarily because of improved contact with fishermen and better catch reports."

Sea Otters

Censuses revealed 576 sea otters between Monterey Bay and Morro Bay.

A legislature-authorized sea otter project was begun. Its purpose is "to reduce competition for abalone." Sea otters will be trapped where commercial fishermen harvest red abalone and be transported to the sea otter refuge.

III. SALMON & STEELHEAD

Because of "continued declines in fishery landings and spawning runs of Central Valley king salmon stocks," the Department recommended sport fishery restrictions to the Fish and Game Commission.

The Department emphasized that "the salmon decline is not the fault of sport or commercial fishermen, but rather is a combination of problems which have reduced the survival of young salmon. These factors included unscreened irrigation diversions, gravel siltation and removal, predation, pollution, vegetation encroachment on spawning riffles, inadequate water flows, and fluctuations of water temperatures due to natural or other causes."

The salmon fishing restrictions recommended by the Department are designed "to prevent further declines in salmon stocks until we can solve the long range problems facing the resource."

Salmon Landings

Commercial salmon landings for 1968 were estimated at 7 million pounds, a half-million below 1967.

The ocean sport catch was estimated at 176,000 salmon; it was 126,000 in 1967.

Sacramento River sport landings were estimated at 17,000 king salmon and 19,700 steelhead.

Oregon

WILLAMETTE STEELHEAD POPULATION INCREASED IN STATE PROGRAM

The Oregon Fish Commission has announced that more than 3,500 adult winter steelhead were transplanted into Willamette River tributaries during December 1968 and January-February 1969 in the third year of its program to develop the Willamette system's natural spawning potential for winter steelhead.

The early-run fish were surplus to egg-take requirements and stream needs at the commission's Big Creek and Klaskaine hatcheries. The fish were trucked and released into Willamette Valley streams devoid of winter steelhead or having only a few.

Adult-Hauling Program Successful

Success in the adult-hauling program was verified recently by a survey of spawning nests (redds) on 4 of the planted streams.

Earlier counts over Willamette Falls seemed to substantiate success of attempts to introduce an early run. The first winter steelhead passing the counting chamber at Willamette Falls' new fishway was recorded on Sept. 22, 1968; by the end of Dec. 1968, over 2,500 steelhead had been counted over the falls. In past years, no significant number of steelhead had been recorded over the falls prior to January or February.

Another Program Helped Too

The earlier arrival of steelhead at the falls, however, results partly from another Fish Commission program. In 1968, in an effort to establish an earlier run and develop unutilized natural spawning areas, the Fish Commission completed an extensive 4-year steelhead smolt liberation program on the Yamhill River. During the past 2 years spawning adults from these plants also have been verified by Fish Commission biologists.

The Commission states that development of an early run of winter steelhead is desirable. Steelhead fishing could be spread over a longer period, and 'the sportsmen given a bonus run to go after before the wild stocks of steelhead and spring chinook hit their peaks.'

* * *

GOVERNOR DEDICATES ULTRAMODERN ELK RIVER SALMON HATCHERY

Governor Tom McCall formally dedicated on April 18 the Oregon Fish Commission hatchery at Elk River. The dedication capped years of planning and construction in cooperation with BCF.

The hatchery is near Port Orford. The planners made it attractive and functional--without disturbing the site's natural beauty. All electrical hookups were laid underground. Unobtrusive pumping systems carry water to the rearing ponds.

The Hatchery

The hatchery will provide the salmon stock for the major tributaries of southern Oregon. Plans call for rearing about 1 million fish in the first year: 850,000 fall chinook and 150,000 coho. Liberation is planned for the Elk and Chetco systems and the Floras Lake area.

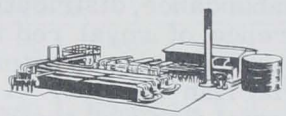
Hatchery fish will be kept in rearing ponds as long as they normally would spend under natural conditions in the streams. Then they will be liberated and return directly to the sea. This will ensure that hatchery fish do not compete with wild fish in the streams; it will allow natural spawning to continue under "the most fruitful circumstances." The Commission states: "Couple the hatchery migrations and the natural migrations, and the outlook for total southern Oregon fish production assumes exciting proportions."

The equipment will feature Burrows rearing ponds. This design keeps the water circulating in the ponds at all times and the fish swimming. The result is much stronger fish with greater endurance. This leaves little opportunity for sick fish to congregate in quiet water.

The ponds are self-cleaning and are expected to result in a much higher survival rate. Also, adult holding ponds have been built with a fishway and support buildings housing freezer storage of the "Oregon Pellet," shop, garage, electrical control equipment, and incubation room. A stream bed filtration system will draw water from the river and carry it to the hatchery ponds. So continuous circulation essential to healthy hatchery programs will be provided.

Continuing Research

Continuing research will play a part. Studies of the early life history of the fall chinook in the area will be undertaken. A biologist will work in the Elk and Sixes areas. Overall potential of the Curry County streams will be under continuous scrutiny. Complete cost of the Elk River hatchery, the 15th under Fish Commission jurisdiction, was $476,000. This includes the hatchery facility and 3 houses for personnel and families.



Texas

8,000 TAGGED SHRIMP RELEASED

BCF and the Texas Parks and Wildlife Dept. released 8,000 tagged brown shrimp off the upper Texas coast during February and March. BCF is offering a reward of $2 for each tagged shrimp returned along with information on where and when it was caught.

Biologists will use information collected from this experiment "to estimate shrimp abundance, winter survival, and spawning potential of brown shrimp remaining on the grounds."

Growth rates and movements of shrimp also will be studied. This information will help to determine the effects of fishing on shrimp stocks and the proper timing of the shrimp harvest to insure maximum annual catch.

Tag

The tag consists of 2 small green disks held on either side of the shrimp's tail by a slender wire, which passes through the shrimp. Fishermen who catch these tagged shrimp should freeze or preserve the entire shrimp along with the tag.

BCF personnel will visit shrimp houses regularly to collect tagged shrimp and pay rewards. Rewards will not be paid unless information on exact location and date of capture are recorded.

* * *

A Preliminary Review of the Potential Deep-Water Fishery Off Texas Between 50 and 300 Fm.

R. Spencer Gaille

The Texas Parks and Wildlife Department commenced systematic bottom trawling between 50 and 300 fm. off the Texas coast in July 1967. The primary objective was to determine the abundance, distribution, and seasonal occurrence of royal red shrimp, Hymenopeneus robustus, and potentially valuable industrial fish species. A need exists for supplemental fish and shellfish raw material during seasons or years when commercial quantities of brown and white shrimp are not available.

The 'Western Gulf,' a 72-foot steel shrimp trawler, was used to conduct the preliminary field tests. It is equipped with standard oceanographic instruments and winches capable of trawling to depths of 500 fm. Shrimp trawling gear consisted of a single 45-foot, $2\frac{1}{4}$-inch, nylon stretch mesh flat otter trawl.

ROYAL RED SHRIMP

Results of deep water work by the 'Oregon' (Springer and Bullis, 1956, Bullis and Thompson, 1965) indicated that commercially exploitable quantities of royal red shrimp were not available off the Texas coast. Their catches of 5-30 pounds per 3-hour drag with 80- and 100-foot trawls southeast of Port Aransas, Texas, were extremely small when compared with catches of 90-120 pounds per 3-hour drag east of the Mississippi Delta. However, the Oregon occupied only 30 trawl stations off Texas in the depth zone inhabitated by royal red shrimp. The small number of stations occupied suggests that further trawling effort is needed.

The maximum yield per 2-hour tow in over 75 attempts by the Western Gulf was 25

Photo: Texas Parks & Wildlife Dept.

Mr. Gaille is a Marine Biologist, Texas Parks and Wildlife Dept., Rockport, Texas.
This study was conducted in cooperation with BCF under PL 88-309 (Project 2-47-R).

pounds; usually less than 5 pounds was caught. These results, then, substantiate those of the Oregon.

FISH OF INDUSTRIAL OR MARKET VALUE

Three species of trawl-caught demersal fish were taken in samples from 50 to 100 fathoms, the wenchman snapper (Pristipomoides andersoni), the scalyhead scorpionfish (Pontinus longispinis), and the spotted hake (Urophycis regius).

The wenchman snapper varied in weight from $\frac{1}{4}$ to $\frac{3}{4}$ pound and averaged $\frac{1}{2}$ pound. It possesses the typical qualities of a panfish having firm flesh and above-average taste. Mosely (1965) did some unpublished age determination research on wenchman from the Gulf of Mexico. Little else has been done on its life history or commercial possibilities.

This small reddish snapper schools over rough and mud bottom. Individual fish are believed to be scattered thickly along the bottom with dense circular schools often extending upward 20 feet. Over 400 pounds were caught in a 2-hour drag at a depth of 80 to 90 fathoms east of Port Isabel, Texas, in November 1967 with a 45-foot, 3-inch stretch mesh fish trawl. There are no estimates of catching efficiency of the 45-foot standard shrimp trawls which produce sizable catches of wenchman at times. While this type of net is not adapted to the capture of bottom dwelling fish, catches do indicate the availability of several fish species which may warrant further explorations with suitable gear for a gross determination of abundance.

Scalyhead scorpionfish, averaging $\frac{1}{3}$ pound, were common from 70 to 130 fathoms. Spotted hake, which averaged $\frac{1}{2}$ pound, were narrowly confined to the 90-fathom zone.

Table 1 - Numbers, Weights, and Lengths of Wenchman Snapper, Scalyhead Scorpionfish, and Spotted Hake, Taken in 1-Hour Trawls at Depths of 40, 50, 70, 90, 130, and 165 Fathoms with a 45-Foot, $2\frac{1}{4}$-Inch Stretch Mesh Trawl East and Southeast of Port Aransas in July and October 1967

Depth	Wenchman Snapper			Scalyhead Scorpionfish			Spotted Hake		
	No.	Lb.	Length mm.	No.	Lb.	Length mm.	No.	Lb.	Length mm.
40	0	-	-	0	-	-	0	-	-
50	50	25	120-210	0	-	-	0	-	-
70	75	35	120-200	25	9	130-200	0	-	-
90	100	48	110-200	50	17	90-150	30	15	220-450
130	10	5	120-170	30	12	110-170	0	-	-
164	0	-	-	0	-	-	0	-	-

Only small number of the Gulf silver hake (Merlucius magnoculus) were caught in 1967. Subsequent efforts in 1968 produced generally the same findings with the Gulf hake, U. cirratus, continuing to be the predominant species between 130 and 300 fm. Table 2 provides catch information and depth distributions for the 2 species in 1967.

Table 2 - Numbers, Weights, and Lengths of Gulf Hake, and Gulf Silver Hake Taken in 1-Hour Trawls at Depths of 130-300 fm. with One 45-Foot, $2\frac{1}{4}$-Inch Stretch Mesh Trawl East and Southeast of Port Aransas in July and October 1967

Depth	Gulf Hake			Gulf Silver Hake		
	No.	Lb.	Length mm.	No.	Lb.	Length mm.
130	32	37	150-320	8	4	160-225
165	58	40	110-460	2	1.5	190-220
200	84	40	240-510	3	2	205-380
250	10	12	240-310	6	6	200-310
300	15	18	250-500	11	8	300-380

SUMMARY

Royal red and associated deep water penaeid shrimp have been found in only small numbers during explorations of the 200-300 fm. depth zone. The commercial fishery potential of these shrimp in deep water off the Texas coasts is doubtful.

Wenchman snapper are excellent panfish, and are known to inhabit the 50-100 fm. depth interval. Further investigations directed to determining abundance might be practicable because it is a commercially interesting species that may exist in commercial quantities.

Similarly, beyond 100 fm. the Gulf hake (Urophycis cirratus) may exist in quantities suitable for commercial harvest. This species is less desirable than wenchman snappers in terms of palatability; it would probably be considered as an industrial species if and when it is commercially utilized.

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