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COMMERCIAL FISHERIES *Review*

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COVER: Fishing port of Hvide Sande, west coast of
Jutland, Denmark. (Inga Aistrup Foto)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.



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Gloucester, Mass.

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Sorting the species.

BCF IS SHAPING MASTER PLAN TO AID U. S. FISHING INDUSTRY

The Bureau of Commercial Fisheries is devising a plan that will evaluate the status of 28 fisheries and systematically determine the projects necessary to solve their most urgent problems.

At the beginning, this master plan would be useful primarily for Federal programs. Later, after industry, academic institutions, State governments, and public or private agencies concerned with the fishing industry have analyzed and contributed to it, the plan would be elevated to the rank of a national plan.

The plan was introduced to fishery groups meeting in Miami Beach, Fla., on June 10 by BCF Director H. E. Crowther. He said several segments of the fishing industry face financial difficulties, while for others, if appropriate action is taken, "prosperity could be just over the horizon." The problem facing all persons concerned with the industry is how to set a course "so that the industry as a whole can prosper."

Director Crowther stated: "Never in the history of the U. S. fishing industry have so many been so concerned about the direction in which our fisheries are heading." The following developments have contributed to this state of affairs:

- Hundreds of large, modern, foreign trawlers have appeared off U. S. coasts and changed the fishing future for U. S. fishermen. If the latter do not fish these resources, foreign fishermen will.

- At least one-half of humanity suffers from malnutrition. World leaders have begun to realize the ocean's potential in feeding the hungry.
- There is need for oceanographic research to tap the ocean's wealth, study the ocean floor, and for military operations.
- Foreign seizure of U. S. vessels has thrust fishing onto the world diplomatic stage.
- The U. S. has not increased its catch in the past 10 years, while other nations have made remarkable gains.

Against this background, BCF began to take a harder look at its own past efforts, programs, and goals to see if it was using its money most effectively. The Bureau came to several conclusions:

- It is a mistake to assume that a few, or even all, actions would solve all or most industry problems. There is no single fishing industry. There are harvesting, processing, and distributing segments. There are many fisheries. And many of these can be broken down into smaller segments on the basis of geography, gear or vessels used, and types of markets and products for which the fish primarily are caught. Each segment "must be treated separately in order to identify the problems and decide what is needed to provide solutions."

● The efforts of those working on fishery problems are spread over about 250 species. In the past, "it has been possible to attack only a few of the most critical ones."

● Never have the U. S. fisheries received so much attention. Many individuals and groups are concerned about the fisheries, yet our course is not clear. The belief that problems should be identified on a fishery-by-fishery basis impelled BCF to start developing a "Master Plan for Commercial Fisheries."

THE BCF PLAN

In its final form, the plan will divide U. S. fisheries geographically: New England, Mid-Atlantic, South Atlantic, Gulf, etc. Each section will contain information on major fisheries in one area. In New England, for example, such species as haddock, cod, yellow-tail, lobster, and herring will be included. For each of these fisheries, there will be a priority list of work needed. Each item of work will contain an estimate of cost, and designate the body responsible for carrying it out: industry, a university, a State, or the U. S. For the BCF plan to become a national plan, there would have to be agreement among all groups regarding "priority, cost, and responsibility."

Fashioning the Plan

● BCF selected 28 fisheries with which to work initially. These account for over 90 percent of the U. S. catch both by volume and value. Additional fisheries will be included as experience is gained with the plan.

● The second task was to find a method of selecting projects or actions necessary to solve the most pressing problems of a fishery. Because BCF's experience showed that it is almost impossible for any person to consider all of a fishery's possible needs when determining priorities, the Bureau developed a checklist. This checklist is divided into 5 major categories: resource supply; access to and efficient harvesting of resource; handling and processing (aboard vessels and ashore); distribution and marketing; fundamental knowledge. And these 5 categories are divided into many components.

BCF "attempted to include in the checklist all actions or projects that maybe needed in any U. S. fishery. It is simply a means of insuring that all possible courses of action are considered when a program of work is being developed."

Before the checklist can be used meaningfully, there must be agreement on the objectives of work to be included in the Master Plan. Suggested national objectives are being developed.

● To produce a working document involving each major fishery, BCF selected from the checklist those actions or projects necessary to accomplish the national objectives. These projects--in order of priority--would give the proposed program for that fishery or species. Shown on next page are sample priority lists developed for thread herring and king crab.

THREAD HERRING
Priority Areas of Work

Resource Supply

Resource assessment

- Distribution in time and space
- Magnitude and potential yield
- Commercial feasibility

Access to and Efficient Harvesting
of Resource

Improved harvesting efficiency

- Gear development and improvement
- Fish behavior
- Economics of harvesting
- Prediction, including intelligence system
- Extension

KING CRAB
Priority Areas of Work

Resource Supply

Maintaining the yield

- Life history
- Population dynamics
- Subpopulations
- Environmental relationships
- Prediction
- Economic, political, social and legal aspects, domestic and international

Statistics

Resource assessment

- Distribution in time and space
- Magnitude and potential yield
- Commercial feasibility

KING CRAB (Contd.)
Priority Areas of Work (Contd.)

Assess to and Efficient Harvesting
of Resource

Resource allocation

- Domestic versus international fisheries
- Limited entry

Distribution and Marketing

Quality maintenance

- After the list is completed, program planning experts must assign costs and time periods to the priority actions. Because items on the priority list identify only major work areas, specialists will have to develop detailed project plans.
- Limited financial, physical, and human resources make it impossible to implement all items for all fisheries. "So the final question becomes: Which fisheries are most urgently in need of assistance or can be helped most effectively with limited program dollars?"

The answer seems simple: Invest in fisheries with the greatest potential--or where the payoff per dollar spent is greatest. Actually, the answer is not quite that simple. More detailed information must be obtained before some decisions can be made. BCF is moving to improve its information base. The Bureau "is convinced a Master Plan will provide a systematic approach to select among alternatives."

● BCF will consult with all interested public and private groups to complete the Federal plan and then develop it into the form of a national Master Plan for Commercial Fisheries.

Such a comprehensive national plan would have many advantages. It would

1. Consolidate thinking in the commercial fisheries and provide agreement on charting the course for the future.

2. Avoid duplication of effort.

3. Guide BCF and the States in matching-fund programs.

4. Permit orderly development of legislation needed for the fisheries.

5. Give U. S. and State appropriation agencies the information about the fisheries that is needed to make decisions.



Dressing fish. (J. J. Murray)

UNITED STATES

U. S. Trades Fish With USSR

The U. S. has obtained from the Soviet Union the only species of pike foreign to North America--the Amur pike. In return, the Soviet Union received shipments of 20,000 newly hatched striped bass and 50,000 steelhead trout eggs. All shipments arrived in Moscow in satisfactory condition. This was the fourth and largest exchange of fish and fish eggs between the two countries. The purposes of the trades are to further science and to help the USSR increase its food supply.

Amur Pike Research

The Amur pike--over 1,000 healthy fry--have been given to Pennsylvania for genetics research and related projects.

If enough pike survive, some will be placed in reservoirs. There is the possibility of a new American sport fish--if the Amurs thrive in Pennsylvania waters. They occasionally grow to 40 inches and 35 pounds. Their natural habitat is the Amur River separating China from the Soviet Union.

Began In 1964

Limited exchanges of fish and fish eggs followed discussions begun in 1964 by Interior's Fish and Wildlife Service and the Soviet Union's All-Union Research Institute of Marine Fisheries and Oceanography.

A series of striped bass, steelhead trout, and smallmouth bass shipments was made to the USSR in exchange for sockeye salmon. Transportation problems often caused mass mortalities. No exchange was attempted in 1967.

Sockeye salmon, received in 1965, are the subject of research at the BCF laboratory in Bowman's Bay, Wash.



Report Analyzes Ocean's Economic Effects on Southern New England

In 1965, 11.1 percent of total personal income in the Southern New England Marine Region was produced by economic activity directly dependent on the closeness of the ocean. This is revealed in a recently published study by economists of the University of Rhode Island (URI).

The Southern New England Marine Region includes Rhode Island, New London County, Conn., and Barnstable, Bristol, Dukes, Nantucket and Plymouth counties, Mass.

The study focused on the impact of ocean and continental shelf resources on the economy of a coastal region. It was designed to help planners develop those resources. The economists say their study of the southern New England region can be applied to other regions--if marine activities there operate in a similar framework.

The study was part of a cooperative program with the U. S. Department of Commerce's ESSA and Economic Development Administration. It is one of several projects Commerce agencies are supporting to encourage economic development of the continental shelf and coastal regions.

The Study Findings

The 11.1 percent figure did not include money spent by tourists in such nonmarine places as motels, restaurants, and gas stations.

A URI team surveyed 400 individual ocean-oriented businesses during the summers of 1965 and 1966 to gather the data.

The report divides the marine industries into 13 categories: fish catching; fresh fish processing; frozen fish processing, fish wholesaling and jobbing; ship and boat building; marinas and boat yards; marine retail and wholesale; marine manufacturing; construction, towing, agents; research and education; marine military; charter fishing; and other marine activities.

In the Southern New England Marine Region, the gross sales of ocean-oriented businesses were \$773,049,000 in 1965. The ship and boat building category had the highest sales: \$318,290,000. The marine military category had the greatest effect on personal income because the Navy spent much on wages and salaries.

Stimulates Economy

Activities based on catching, processing, and using fish can stimulate the region's economy: "A modest rate of growth in landings value of 1 percent per year over 5 years (\$284,840 the first year) would yield an average annual increase of \$769,583 in gross output of the region. . . . The resulting average annual rate of increase in personal income is .66 percent in the region and gross non-marine output would increase at an average annual rate of .26 percent."

To make it easier to use the data in other regions, the report describes the physical and economic setting of the Southern New England Marine Region. It covers land environment, coastal and offshore environment, the region's economy, population, labor market, and patterns of trade. There are maps of topography, river basins, tidal currents, average annual precipitation, mean temperatures for January and July, transportation network, population density, and land use.

The 132-page report is titled, "Economic Impact of Marine-Oriented Activities--A Study of the Southern New England Marine Region." It was prepared by Niels Rorholm (chairman), Harlan C. Lampe, and Joseph F. Farrell of URI's department of food and resource economics, and Nelson Marshall of the Graduate School of Oceanography.



Save-the-Estuaries Campaign Is Announced

A national campaign to alert the public to the critical condition of the Atlantic Coast estuaries has been announced by the American Littoral Society of Sandy Hook, N. J. The Society's campaign will cover the coast from Maine to the Gulf of Mexico. It will include

an inventory of estuarine resources, surveillance of operations that threaten those resources, and a program of conservation education.

John Clark, Society President, said: "In the recent development of interest in the ocean depths, we seem to have lost sight of the importance of the estuaries. The wealth of our estuarine frontier, including the coastal marshes, tidelands, bays, sounds, and tidal rivers is being rapidly dissipated because of the lack of understanding of their unique values."

The program is funded by grants from the Old Dominion Foundation and the American Conservation Association.

The Society's Program

The Society will concentrate on these estuarine problems: "the effects of pollution upstream, at the bay mouths, and offshore; the conflict between developing estuarine areas for housing and industry and preserving them for fishing, recreation, nature study, and scenic enjoyment, the conflict between the navigational and the ecological needs of estuaries; and the complexities of local, state, and Federal laws which govern the use of coastal lands."

Clark added: "Our area of interest is under heavy population pressures. Almost half the Nation's population lives within a day's drive of the coast. Over 50 percent of the estuarine area has already been lost in certain areas and this is the area where about 65 percent of our fish population either breeds or spends its juvenile period of growth.

"There has to be a balance between the legitimate human needs for space on the coastline and the wildlife needs for the same area. If this balance is not struck soon, the values which attract man to the ocean will be lost forever. An acre of marsh covered with refuse or filled in for housing is a lost resource and these resources are being lost too fast.

"Our program will take into account the needs of the commercial fisherman, the sports fisherman, the boat owner, the people who simply wander the beaches and marshes, as well as the needs of communities and industries located near the shore."

The American Littoral Society is a national, nonprofit organization started in 1961 by fishermen, skin divers, and nature lovers interested in preserving the estuarine area. It has thousands of members.



Mechanical Feeder Aids Fish Farmer

A mechanical fish feeder has been invented by the director of training programs for the Arkansas Office of Economic Opportunity, Dr. Earl E. Evans. He says it will reduce the farmer's work and insure equal distribution of feed. Dr. Evans operates a 45-acre farm of blue and channel catfish near Pine Bluff, Ark. He added that one man using the mechanical feeder could distribute as much feed in an hour as 10 men working by hand in the same time.

Dr. Evans noted that the feeder was made up of a hopper that holds 600 pounds of pellet or bran feed, a blower fan, and a feeder pipe. The machine can be mounted on almost any farm tractor. It is run by the tractor's power takeoff.

How It Works

Dr. Evans pointed out that the machine could blow the feed as far as 15 feet from the banks of the pond. This would make for more even distribution of feed. When feed is spread by hand, he said, most of it will be at the pond edges. The fish in the middle would not get as much. With his portable mechanical feeder, the farmer can circle the pond and get equal distribution.

He began work on the feeder in 1966 and perfected it early this year. He was granted patent pending rights in January. Dr. Evans said the machine is not in full production yet, but some are produced on special order. ("Feedstuffs," June 8, 1968.)



Interior Apportions Funds to States for Fish and Wildlife

On July 1, \$22.1 million in Federal Aid funds for fish and wildlife restoration became available to the 50 States--an increase of \$1.5 million over last year's record.

Of the \$22.1 million, \$17.4 million is for wildlife restoration, and \$4.7 million is for sport-fishery projects. Another apportionment for fish and wildlife restoration projects will be made in the fall.

Excise Taxes Provide Funds

The fish and wildlife funds come from Federal excise taxes collected from manufacturers, importers, and producers of certain types of hunting and fishing equipment.

Under the Federal Aid programs, States are reimbursed up to 75 percent of the cost of approved projects. The laws creating these programs also provide \$10,000 each to the Commonwealth of Puerto Rico, Guam, and the Virgin Islands. The 1969 fiscal year apportionments to these areas are included in the total apportionment.

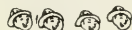
Distribution of funds is based on the number of paid hunting and fishing license holders in a State and the area of that State. The programs are administered by Interior's Bureau of Sport Fisheries and Wildlife.



"People to People" Tour of South America

Dr. Mark Keyes, a staff veterinarian of the BCF Marine Mammal Biological Laboratory, Seattle, Wash., completed a 28-day "People to People" tour of 7 South American countries. He was part of a 12-person delegation of veterinarians and wildlife scientists.

Their objective was to contact their counterparts personally in order to establish the lasting lines of communication that could promote goodwill and understanding between the U.S. and South American countries. The tour was initiated by the Citizens Ambassador Travel Program, an organization formed under President Eisenhower's leadership when he was in office.



OCEANOGRAPHY

U. S. Invites World to Join in Decade of Ocean Exploration

The United States is urging all nations to join in a 10-year effort to explore the world's oceans. The invitation is contained in a report released on May 29 by the National Council on Marine Resources and Engineering Development. The Council, better known as Marine Sciences Council, is a Cabinet-level advisory group headed by Vice President Humphrey.

The report elaborates on President Johnson's proposal of March 8, 1968, for an International Decade of Ocean Exploration in the 1970s. It seeks to encourage development of the "Decade" concept by scientists, engineers, and representatives of industry and governments. It gives examples of the kinds of projects that nations might undertake--and discusses aspects of the projects that must be worked out together.

The report notes that a joint non-Government/Government planning staff will be created under the Council to plan the U. S. contribution to the Decade. It invites the scientific and technical communities to take part in this planning, especially through the National Academies of Science and Engineering.

The President's Proposal

Following his proposal, the President stated that the activities of the Decade could:

- "expand cooperative efforts by scientists from many nations to probe the mysteries of the sea;
- increase our knowledge of food resources, to assist in meeting worldwide threats of malnutrition and disease;
- bring closer the day when the people of the world can exploit new sources of minerals and fossil fuels."

The Concept

Science has shown that the ocean is an important source of food and minerals for a booming world population. The capability now exists to explore the seas. Because of the vastness and complexity of the marine environment, a broad program of exploration can be carried out only through international cooperation. The Decade can further the

economic and scientific development of all participants. It can develop resources, especially new sources of food, badly needed in the world's developing areas. "Thus, emphasis should be placed on the identification and assessment of food and mineral resources as well as investigation of ocean processes."

Geographical Exploration

To realize the sea's full food potential, scientists will have to assess unused fish stocks "readily available to current fishing techniques." Also, there are known resources in the deep ocean and in mid-depths that cannot be harvested economically at the present time.

The report states: "Expanded efforts to locate fish more precisely, increase the efficiency of capture, and predict abundance and availability of the stocks on a seasonal basis should lead to substantial improvements in fish catch. Increased efficiency also will expand the need for scientific management techniques to avoid overfishing and disturbing the ecological balance. Improved understanding of fishery resources and their reactions to natural and manmade disturbances is necessary to increase and maintain the yield and to resolve international fishery conflicts."

There is need to learn much more about the "composition and distribution of nonliving seabed resources." The growing demand for energy and minerals has spurred the search for these resources on the Continental Shelf.

Development of National Programs

Almost every operation a nation conducts to investigate or operate in the marine environment aids its general capability to explore the oceans and to understand them better. And, the report emphasizes: "During the Decade all nations would be encouraged to identify how ocean exploration can contribute to scientific and economic development, and accordingly

- develop their capabilities for exploring the oceans;
- expand national ocean exploration programs; and
- share with other nations experience and scientific data acquired from these national programs."

Most nations are interested primarily in ocean exploration programs close to home shores--"exploration of the Continental Shelf and of coastal fishery stocks." Some nations are moving their investigations farther out to sea. But most ocean exploration in the foreseeable future will probably continue to be coastal activity. However, if nations conducting this kind of activity would share their experiences and data, other nations would benefit. "Advances in marine science and technology depend critically upon the effective flow of information--from data collectors to data consumers."

The existing national and international systems for exchanging the ever-increasing marine data have to be strengthened. Attention should be paid to the "compatibility of national data systems."

National programs to improve navigational accuracies can contribute much to the Decade's success.

"Skilled manpower is essential for any nation to enhance its capabilities for exploring the oceans."

Suggested International Projects

The report of the Marine Sciences Council suggests the following types of projects "as a point of departure for international discussions":

- "surveys of selected ocean areas, principally from oceanographic ships, complemented by increasing use of other platforms such as spacecraft, buoys, submersibles, and ships of opportunity;
- intensive study of designated ocean areas of limited expanse;
- research directed to specific ocean phenomena;
- development of improved world-wide data collection, processing, storage, and distribution facilities and services to facilitate international exchange of data; and
- assistance in strengthening the capabilities of the developing nations to participate in exploration programs, including manpower training."

The report puts forward these types of objectives for international collaborative projects:

1. Exploration of Living Resources

Assessment of living resources useful to man in uncharted regions of the world ocean.

Assessment of current utilization of known fishery stocks.

Acquisition of knowledge relating living resources to their environment in order that greater efficiency in their capture and conservation can be achieved.

2. Exploration of the Ocean Floor

Determination of the geological structure and mineral and energy resource potential of the world's continental margins.

Preparation of topographic, geological, and geophysical maps of selected areas of the deep ocean floor.

Coring and drilling on the continental margins and deep ocean floor in selected areas.

3. Exploration of Ocean Processes

Study of scales of motion in the sea and the dynamics of ocean current systems.

Investigations of surface boundary processes, such as the growth and propagation of ocean waves.

Investigations of evolutionary processes of ocean basins.

4. Assistance to the Developing Nations

Mapping of selected areas of the Continental Shelf of developing nations.

Surveys of the coastal fishery resources of the developing nations."

Past International Cooperation

The report notes the record of international cooperation by scientists throughout the world to show that a good basis exists for cooperation in the 1970s. It mentions the International Geophysical Year in the late 1950s, the International Indian Ocean Expedition, the International Cooperative Investigation of the Tropical Atlantic, the Cooperative Study of the Kuroshio, and the work of international organizations and of scientific bodies.

The report urges that international planning for the Decade be "pursued as quickly as practicable." The U. S. has begun discussions with other nations on the concept of the Decade. "The U. S. has not attempted to prejudge the scope, the international collaborative projects which would develop, nor the international arrangements for planning and coordination."

And the Marine Sciences Council points to a primary target: "The continental margins will undoubtedly provide the greatest economic return during the Decade. However, the deep oceans cover by far the largest and least known areas. It is in the deep oceans that international cooperation will provide a common scientific return leading to future economic reward. Because of the high cost of operations at sea, it is of great importance that plans be coordinated internationally to insure that areas with the highest potential interest to the most users be given priority attention."



WHAT IS THE PRESSURE AT THE DEEPEST PART OF THE OCEAN?

The pressure at the deepest part of the ocean is close to 7 tons per square inch, almost a thousand times the atmospheric pressure on the earth's surface.

At a depth of 3,000 feet, a pressure of 8, 100 pounds per square inch is sufficient to squeeze a block of wood to half its volume so that it will sink.

At a depth of 20,000 feet, air will be compressed so much that it will weigh as much as the surrounding water. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

First Estuarine Prediction Service Launched

The first estuarine prediction service in the U. S. has been launched. The Federal Government hopes it may develop into an important service for government and private agencies in pollution control.

The service will be conducted by ESSA as a 1-year pilot program for Penobscot River and Bay Estuary in Maine. Other Maine estuaries may be added later. The possible expansion of the program to other states will be considered.

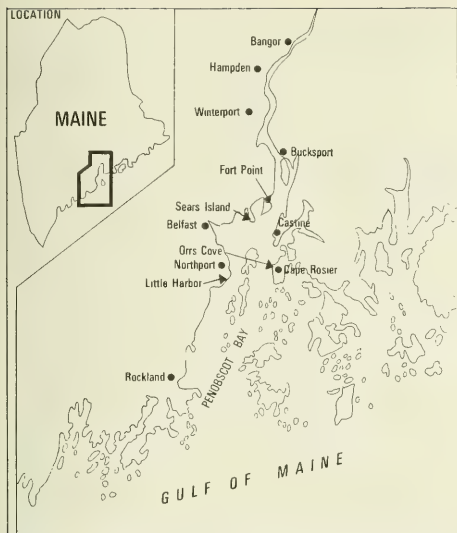
The predictions will be made by ESSA's Coast and Geodetic Survey--with the necessary river discharge forecast and advisory information provided by ESSA's Weather Bureau.

The program is designed to aid Federal, State, county, and municipal agencies and private industries concerned with water pollution. It is concerned with fisheries, public health, recreation, drinking and industrial water, sewage, industrial wastes, and both industrial and residential development.

How Program Will Work

Advance forecasts will be issued the 3rd and 18th of each month on the rate possible pollutants will pass through the estuary. The rates will be computed through the modified tidal prism concept developed by B. H. Ketchum of the Woods Hole (Mass.) Oceanographic Institution.

The "flushing rate" is the average time fresh water or suspended matter (potential pollutants) will remain in various parts of the estuary. Such predicted rates will give the number of days fresh water or suspended matter need to travel from selected points past the outer end of the pilot area at a line extending from Cape Rosier to Little Harbor. "The selected points are at lines drawn across the estuary at Bangor, Hampden, Winterport, Bucksport, Fort Point, southern tip of Sears Island, Belfast to Castine, and Northport to Orrs Cove. The predictions can also be made for any other points along the estuary."



Penobscot River and Bay Estuary in Maine where Nation's first estuarine prediction service is being launched. The Federal Government hopes it may develop into an important pollution control service for government and private agencies.

Service's Practical Effects

Charles R. Muirhead, acting chief of Coast and Geodetic Survey's Oceanographic Predictions Section, described the service's practical effects:

"Let us assume that various commercial wastes are being deposited at the head of the estuary. Dependent on the rate of speed at which these wastes travel, they will either pass to the ocean without any harmful effect to the estuary or they will slow down and perhaps pollute the areas in which they linger.

"A decrease in the water's flow and circulatory patterns, such as may occur during the summer months when rainfall is normally reduced, may cause the water to become polluted.

"This service will enable State and local authorities to institute possible remedial measures to reduce the rate at which potential pollutants are being added to the water until the water flow increases."

Muirhead said the service could be "of tremendous importance to commercial and sport fisheries, wildlife conservation, and recreational activities during summer months, including swimming and boating."

The forecasts will be issued to Maine and Federal agencies.



Bering Sea Floor Survey Planned

The U.S. is undertaking an extensive survey this summer of the continental shelf beneath the Bering Sea. It will include a search for indications of gold, tin, platinum, or petroleum beneath the sea floor.

The survey is being conducted by scientists of ESSA and Interior Department's Geological Survey as part of a long-range national program to map the 862,000 statute square miles of the continental shelf--the last frontier of the U. S.

The survey will be concentrated off Nome, Alaska, between St. Lawrence Island and the Seward Peninsula, in western Norton Sound. It will be the most comprehensive survey of these waters ever made.

A Different Gold Rush

During the gold rush of 1896-99 there was gold placer mining of the sands at Nome. Now the search for gold is turning to the waters offshore, where old beaches and stream deposits exist. The Norton Sound area was uncovered during the Ice Ages. Then, the sea level was much lower than today, and gold was concentrated along streams and beaches as it is today. This was confirmed by U. S. Geological Survey reconnaissance last year. It was conducted in cooperation with the University of Washington and the U. S. Bureau of Mines. The survey also showed the presence of thick layers of sedimentary rock under much of the northern Bering Sea. This raised the possibility of petroleum deposits under Norton Sound.

The Operation

The survey will be conducted from 2 Seattle-based ships of ESSA's Coast and Geodetic Survey, the USC&GSS "Surveyor"

and "Oceanographer." The Surveyor was scheduled to be in the area from June until September; the Oceanographer from about mid-July until late August.

The ships will map the offshore area using precise electronic navigational control. Sediment samples of the Bering Sea bottom and profiles of the geologic formations beneath the sediment will be obtained on the ships by a team of five U. S. Geological Survey (USGS) scientists. The samples will be analyzed for mineral content at the USGS laboratories, Menlo Park, Calif.

Data gathered will be analyzed by scientists of both agencies. The survey will provide data for bathymetric maps showing the shape of the ocean floor, for nautical charts, and for magnetic anomaly and gravity anomaly maps. These Coast and Geodetic Survey maps will provide a base for plotting the sediment analyses and profiles of the geological structure. This will permit the Geological Survey geologists to evaluate mineral and oil potential under Norton Sound.

Geologic Information

The survey also will provide geologists with information on the area's geological history. It may prove possible to map the outline of shorelines, river valleys, and glacial deposits that once existed above sea level.

The scientists will search for submerged beach ridges and stream valleys to determine the area's drainage pattern when it was emergent. The sea valleys are particularly interesting because they drained the area of the gold placer deposits near Nome.

The Bering Sea survey is a pilot project conforming with recommendations of the National Council on Marine Resources and Engineering Development. The long-range view is to extend the program to the continental shelves off the Pacific, Gulf, and Atlantic coasts.

The Alaskan shelf is about two-thirds of the entire submerged area. ESSA currently is surveying the entire shelf. Bathymetric maps of its topography already have been issued for parts of the coast off the Aleutian Islands, Oregon, Southern California, New England, and the mid-Atlantic Coast. The

Geological Survey will use these maps of the geology and mineral resources of the submerged continental margin.



Hydrographic Survey of Long Island Sound Resumed

Detailed hydrographic surveys in Long Island Sound resumed in June as part of a project to chart the Sound's entire length. The project began in 1966 and will take years to complete. It will be the most detailed survey of the Sound since the 1800s.

Surveys will be conducted this year for about 4 months by a 15-man, shore-based, field party and the "Whiting" of the Coast and Geodetic Survey. The surveys will provide the latest navigational information for nautical charts. Such charts are essential for safe navigation in the Sound of seagoing commerce and recreational boating. New data will be incorporated into about 20 existing charts and be used in producing 4 new, large-scale, charts planned for Long Island's north shore.



Study Ancient Alaskan Sea Channel

U. S. oceanographers are studying new data on a sea channel at the bottom of the North Pacific. It is just south of the Aleutian Islands and once connected North America with a vast underwater plain.



Dotted line indicates how sea channel may have once connected the vast Aleutian Abyssal Plain, three miles below the surface of the sea, with Alaska. When the Aleutian Trench was formed some 10 to 50 million years ago, it apparently broke the connecting link. U. S. oceanographers recently investigated the channel for new evidence on the geological history of the area.

Some oceanographers believe it is one of several channels which, in the past, carried mud from land to the Aleutian Abyssal (deep sea) Plain, an area one-half to two-thirds the size of Alaska. The channel is about 3 miles below the surface of the sea.

The plain was cut off from the Aleutian Island Archipelago when a subterranean cataclysm 10 to 50 million years ago caused a segment of the ocean floor--about 50 miles wide and 2,000 miles long--to subside into the earth's crust to form the Aleutian Trench.

Channel Discovered in 1967

The existence of the channel became known only last fall. Scientists regard it as containing evidence that may shed new light on the area's geological history. They state that the trench, several thousand feet deeper than the plain to the south, cut off from the plain vast supplies of mud that once flowed through the channels. In its place, the only deposits received by the plain since the trench was formed were airborne dust and remains of living organisms, known as pelagic "snow fall" sedimentation.

ESSA Survey

ESSA investigated the sea channel in April. It was a cooperative venture of ESSA's Pacific Oceanographic Research Laboratory, Seattle, Wash., and ESSA's Coast and Geodetic Survey Ship "Oceanographer."



Government Boosts Nautical Chart Output

During the summer, an estimated 41 million Americans take to the water in boats--many without the nautical charts essential to all navigators.

To meet the rapid expansion in recreational boating, more nautical charts are being turned out to guide these 41 million Americans safely through navigable waters on the Atlantic, Gulf, and Pacific coasts.

A leader in this program is the Coast and Geodetic Survey of the Environmental Science Services Administration (ESSA). This Commerce Department agency produces about 2,000,000 nautical charts a year to

meet recreational and commercial boating needs. The Coast Survey estimates that 223 new charts may have to be produced during the next 10 years.

Conventional charts are used aboard ships where room for display and plotting is available. These charts range from large-scale harbor charts for navigating in harbors and narrow waterways and for anchoring--to small-scale sailing charts for offshore navigation between distant ports.

Small-craft charts are compact and specially designed for cockpit use. They are valuable, too, as hand-held copies on the bridge of large commercial ships. These accordion-folded charts lead skippers to docks, supplies, and services. Printed on the covers are tides, currents, symbols and abbreviations, and many helpful small-craft notes.

2½ Million Sq. Miles Covered

During the past 125 years, the Coast Survey has produced about 850 separate nautical charts covering about 2½ million square miles of navigable waters. "These charts play an important role in the Nation's economic growth and national security. Long-range plans must promote the development of the waterway systems, increased foreign trade, water-related recreation, and the fishing industry to meet the requirements of an expanding population."

This job entails extensive hydrographic surveying along U. S. coasts and estuaries. It includes "the operations of 14 ships, coastal photogrammetric (aerial photo) surveys and mapping; geodetic control surveys; investigations of navigational hazards; nautical chart compilation and maintenance; reproduction and distribution of charts and coast pilot information; and research and development in instrumentation, automation, and cartographic techniques."

Surveying must precede chart compilation, and nautical charts require a great deal of it. This includes hydrographic surveys to chart water depths and bottom topography; wire-drag surveys to find such hidden dangers as pinnacle rocks and wrecks; tide and current observations; and aerial photo surveys to map the coastline. It is estimated that field surveys take two-thirds of each dollar spent to make nautical charts.

Need for Charts Grows

The need for up-to-date nautical charts has increased with the expansion of commercial shipping and recreational boating.

The U. S. Coast Guard reported that 3,373 commercial vessels in fiscal year 1966 were involved in marine accidents. Losses reached nearly \$76 million. A total of 534 vessels was grounded.

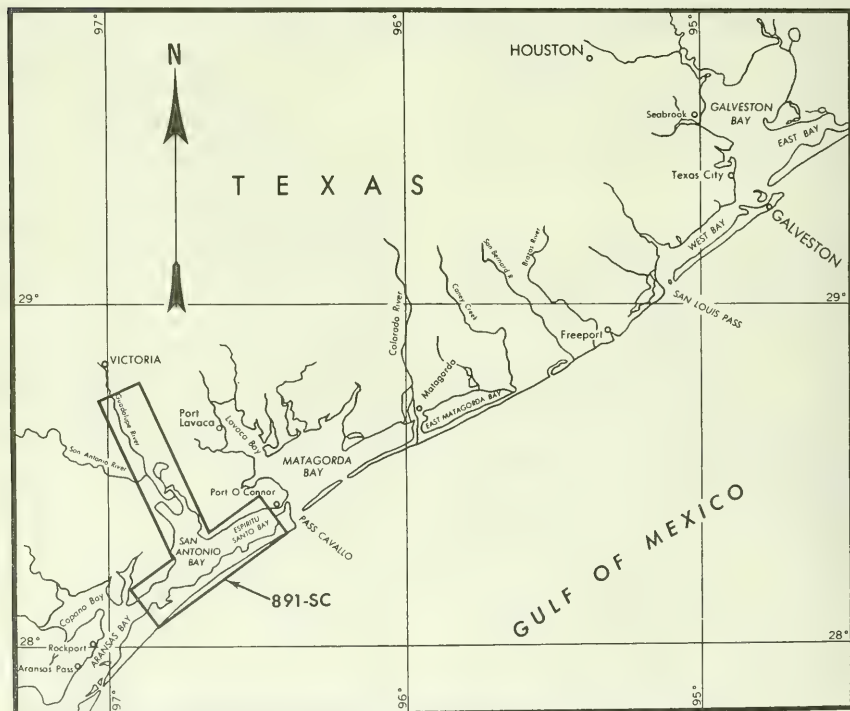
In recreational boating, the number of craft has increased since 1950 from $3\frac{1}{2}$ million to over 8 million in 1966. The Coast Guard reported 4,350 marine accidents involving 5,567 recreational boats in 1966, losses were \$7,334,500. Of the 4,350 accidents, 283 resulted from groundings.



Nautical Chart Issued for Intracoastal Waterway in San Antonio Bay

ESSA's Coast and Geodetic Survey has published a new small-craft nautical chart for the Intracoastal Waterway in San Antonio Bay, Texas. The chart includes for the first time the 9 by 100-foot channel from Long Mott to Victoria. This recently completed channel, connecting with the Waterway in San Antonio Bay, extends nearly 35 miles inland to provide water transportation for recreation and industry.

The new chart (891-SC), produced at a scale of 1:40,000, contains the latest marine data, including that obtained in 1967 by aerial photography. It replaces conventional charts 890 and 891 and costs \$1.50.



Area covered by new small-craft nautical chart being issued by the ESSA Coast and Geodetic Survey for the Intracoastal Waterway in Texas.

Foreign Fishing Off U. S. in May

OFF ALASKA

Japanese: About 140 vessels fished off Alaska during the first half of May--the same number as in April. The pattern of past years was repeated; the number increased to over 400 in second-half May. This resulted primarily from the beginning of the high-seas salmon fishery, and from increased effort in the minced fish meat and fish meal fishery in the eastern and central Bering Sea.

The Pacific ocean perch fishery in the Gulf of Alaska was continued by about 7 stern trawlers during 3 weeks of May. Then the effort dropped to about 5 when 2 moved south to Queen Charlotte Island. The major Gulf activity in May occurred off southeast Alaska in the eastern Gulf.

The perch fishery along the 100-fathom curve in the eastern and central Bering Sea was continued by about 5 stern trawlers during most of May. By month's end, however, the fishery decreased to about 3 vessels--when one transferred to a new herring fishery in the eastern Bering Sea, and another moved south of eastern Aleutians to resume perch fishery. One factoryship, plus 7 trawlers, remained active in central Bering Sea until late May, presumably fishing for ocean perch. At month's end, however, most trawlers were observed fishing for herring in eastern Bering Sea, and it is believed entire fleet had switched to this new fishery.

The trawl fishery for Alaska pollock and flatfish for production of minced fish meat and fish meal was intensified in early May when another factoryship fleet arrived in eastern Bering Sea. This brought to 5 the number of fleets (5 factoryships plus about 88 trawlers). During month, the 5 scattered on Continental Shelf of eastern and central Bering Sea--from just north of Alaska Peninsula to northwest of Pribilofs. Japanese officials reported very good catches being made and, in addition to production of minced fish meat and fish meal and oil, small quantities of fish also are being frozen for human consumption.

The tangle net and pot fishery for crabs in eastern Bering was continued by 2 factoryship fleets. By month's end, both fleets had moved from Continental Shelf just north of Alaska Peninsula to Pribilofs. A similar pattern was followed by the 2 fleets in 1967, and 1 of the 2 fleets in 1965 and 1966. Such moves in pre-

vious years were made primarily because of Soviet competition north of Alaska Peninsula. The Japanese catches this year, like the Soviets', have been predominately tanner crab. The 2 fleets moved to Pribilofs to catch king crab primarily. At least 4 net-setters preceded the 2 factoryships to Pribilofs by 1 month.

The sablefish fishery in Gulf of Alaska was continued by 2 to 4 long-line vessels in May. The major effort was off southeast Alaska coast.

By late May, the Japanese had begun a trawl fishery for herring on the Bristol Bay "flats" about 20 miles south of Togiak Bay. This probably resulted from success of the 3 vessels that searched for herring by fishing with gill nets in central and eastern Bering in April and May. At month's end, at least 12 trawlers and 1 factoryship were fishing. The factoryship and 7 trawlers transferred to this fishery from perch fishery in central Bering.

The 1968 high-seas salmon fishery in North Pacific began in last week of May. As in preceding 6 years, the fishery is being conducted by 11 fleets (11 factoryships and 369 gill-net vessels). The fleets began fishing well southwest of western Aleutians. By end of May, at least half the fleets were working northeast toward the western and central Aleutians.

Soviet: About 50 vessels fished off Alaska during first-half May; in the next 2 weeks, their number was lowest since Nov. 1963. Only about 10 vessels remained at month's end--about $\frac{1}{7}$ number sighted off Alaska in April 1968 or May 1967.

Pacific ocean perch fishing was concentrated along Aleutians; 12 medium trawlers and 2 processing vessels fished south of eastern Aleutians during first 3 weeks, then left. At month's end, only a stern trawler continued to fish for perch south of central Aleutians.

Shrimp fishing on Portlock Bank just east of Afognak Island in central Gulf of Alaska followed the 1967 pattern, when operations began in late March and ended in mid-May. The number of medium trawlers accompanying the 2 Zakharov-class factoryships decreased from 20 in late April to 10 in early May. A BCF agent visited one shrimp-processing floating factory in early May. He was advised

that (1) the medium trawlers had been continually hampered by bad weather since fishery started in March, and so they were not able to achieve planned catch; (2) the shrimp fishery on Portlock Bank would be terminated by mid-May. U. S. fishery patrol units did not find any Soviet vessels on May 14 in the Portlock Bank area.

The trawl fisheries for pollock, flatfish, perch, and gray cod along Continental Shelf edge from Unimak Pass to latitude of St. Matthew Island in central Bering Sea was continued by 15-20 medium trawlers and a few refrigerated transport vessels during first-half May. About mid-May, the number began to decline; by month's end, only about 10 remained active.

Soviet king crab fishing in eastern Bering ended on May 2. A BCF agent who boarded the 2 Zakharov-class factoryships in April was advised that catches were primarily tanner crab; in previous years, such catches were almost entirely king crab. Soviet officials said that if catches did not improve, and if tanner crabs continued to dominate, they would abandon crab fishery much earlier than planned date of late June. The Soviet withdrawal from eastern Bering by May 2 indicates that tanner crab continued to prevail. The Soviets apparently believed the 2 fleets could be used more economically elsewhere.

Two whaling fleets began North Pacific whaling in mid-May. No vessels had been observed near Alaska by month's end; apparently, the fleets are remaining well offshore.

South Korean: After attempting to enter North Pacific fisheries off Alaska in fall 1967, the fleet of "Sam Su No. 301" accompanied by

6 small pair trawlers returned in early May. The fleet proceeded eastward along Aleutians to Unimak Pass, then sailed northwest to central Bering. At month's end, the South Korean fleet was located on or along edge of Continental Shelf west of St. Paul Island. Presumably, it was fishing for flatfish, Alaska pollock, and ocean perch. The expedition had difficulties. Part of the fleet experienced mechanical difficulties, one trawler ran aground, and 2 narrowly missed severe damage when they hit icebergs.

OFF PACIFIC NORTHWEST

Soviet: During May, 56 individual vessels were sighted off Washington and Oregon, compared to 54 vessels in April 1968. Because not all fished entire month, weekly average off Pacific Northwest fluctuated between 35 and 45 different vessels through May (see table). This is considerable decrease from average number observed in 1967, when over 100 were sighted each week.

It was not until week ending May 23 that commercial quantities of fish were observed on Soviet vessels. A side trawler off Oregon had good-to-excellent catches of Pacific hake. Most side trawlers were observed catching up to 10,000 pounds per haul; a couple of pair trawls contained about 75,000-100,000 pounds--mostly hake.

During 4th week, part of fleet moved north off Grays Harbor, Wash. There, and off Heceta Head, Oregon, good-to-excellent catches (primarily hake) also were observed.

Off Oregon, 2 stern trawlers completed hauls of about 60,000 to 80,000 pounds of hake. Several stern trawlers had side bins full of what appeared to be hake.

Soviet Fishing Vessels Sighted Off U. S. Pacific Northwest in May 1968

Week Ending	Area	Type of Vessel					Total
		Medium Side Trawlers	Stern Factory Trawlers	Support Vessels	Research Vessels	Other	
May 9	Wash.	1	-	-	1	1 tug	3
	Oregon	21	13	6	1	1 tanker	42
	Total	22	13	6	2	2	45
May 16	Wash.	-	-	-	-	1 tug	0
	Oregon	17	6	7	2	1 tanker	34
	Total	17	6	7	2	2	34
May 23	Wash.	1	-	-	-	1 tug	1
	Oregon	14	13	5	2	1 tanker	36
	Total	15	13	5	2	2	37
May 30	Wash.	11	-	5	-	1 tug	16
	Oregon	4	15	2	2	1 tanker	25
	Total	15	15	7	2	2	41

During May, the Soviets had 3 medium trawlers off Pacific Northwest. These are probably vessels searching for fish concentrations for the fleet.

OFF CALIFORNIA

Soviet: Foreign fishing decreased during May. Poor weather prevented routine aircraft patrol early in the month, when the Coast Guard reported 8-10 unidentified Soviet vessels off Santa Cruz. During week ending May 17, 7 factory trawlers were sighted fishing 18-20 miles off Russian River. During week ending May 24, only 2 vessels were sighted.

The research vessel "Druzhni" again came to Los Angeles Harbor from May 22-26 to take on fuel and supplies. This vessel, an ex-whaler, reportedly is conducting oceanographic research off Central and South America.

IN NORTHWEST ATLANTIC

An estimated 250 foreign vessels from USSR, Poland, East Germany, and Japan were sighted off U. S. coast in May--a slight increase over number reported in April 1968. The Soviets had the most vessels, averaging between 120 and 130; during one week, they reached 150.

207 individual Soviet vessels were sighted and identified in May; in April, 188.

32 Polish vessels and 9 East German vessels also were sighted.

Two Japanese stern trawlers were intermittently reported off the U. S. coast.

Soviet: Through May, the main fleet was divided into large groups generally dispersed from south of Block Island, R. I., to southwest slopes of Georges Bank. More vessels began fishing those areas in early May, when Soviets suddenly shifted many vessels from mid-Atlantic (off New York and New Jersey) eastward.

Early in May, about 150 Soviet vessels were in a 30-mile area 30-40 miles south of Block Island and Martha's Vineyard. Moderate catches of fish visible on deck appeared to be mostly herring, with some whiting and red hake. By mid-month, fleet shifted to nearby area south of Nantucket Island to

southwest part of Georges Bank. Observed catches were primarily herring and whiting. By month's end, an estimated 140 vessels were dispersed along eastern slopes (southwest and southeast parts) of Georges Bank fishing in 30 to 40 fathoms, primarily for herring.

OFF MID-ATLANTIC

Soviet: In May, 50-60 vessels fished primarily off New York and New Jersey; 100 had been sighted in April. The decrease was caused by shifting operations to southern New England and Georges Bank area.

Early in May, about 40 vessels were spread out from about 40 miles east of Atlantic City, N. J., to 30 to 70 miles south of Long Island. Catches seen on board were mostly herring, with some whiting and red hake. By mid-month, 60 vessels were in Hudson Canyon area 60-70 miles south of Long Island; several vessels were also scattered east of Cape May, N. J. Catches were mostly herring. By month's end, 50 vessels were sighted in a 20-mile area 50 miles south of Montauk Point, L. I.; several vessels were also fishing near Hudson Canyon. Catches on board were primarily herring.

Polish: During May, 25-30 vessels were sighted fishing off New York, New Jersey, and southern New England. Early in month, an estimated 25 were 20 to 40 miles south of Montauk Point and Block Island, R. I. By mid-month, 15 to 20 vessels fished east of New Jersey and south of Long Island. By month's end, those vessels were scattered from New York to eastern slopes of Georges Bank. Herring was primary catch observed.

East German: In May, 6-7 East German vessels (side trawlers) continued fishing among Polish and Soviet fleets. Catches on board were identified as herring.

Japanese: Early in month, 2 stern trawlers were reported fishing off New York and New Jersey. Late in month, those vessels were sighted on southwest part of Georges Bank. Japanese press reported that by end of May 8 to 9 trawlers were expected to be "exploring" off U. S. east coast, specifically off New York and New Jersey. Apparently, the arrival of some of those vessels has been delayed.

IN GULF OF MEXICO AND OFF SOUTH ATLANTIC

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

Note: During surveillance patrols, a certain number of vessels is sighted. The total is recorded; also, each vessel is identified as to type. At month's end, all sighted vessels are counted only once. If a vessel was sighted more than once, it will be counted only once. Since vessels arrive at and depart from fishing areas all the time, the total of identified vessels for the month always will be larger than actual size of fishing fleets observed during individual surveillance patrols.



CRAB DABS



1 can (12 ozs.) Dungeness crab meat or
other crab meat, fresh or frozen or
2 cans (6½ or 7½ ozs. each) crab meat
½ cup fine soft bread crumbs
2 tablespoons dry sherry

1 teaspoon chopped chives
1 teaspoon dry mustard
¼ teaspoon salt
10 slices bacon, cut in thirds

Thaw frozen crab meat. Drain crab meat. Remove any remaining shell or cartilage. Chop the crab meat. Combine all ingredients except bacon. Mix thoroughly. Chill for 30 minutes. Portion crab mixture with a tablespoon. Shape into small rolls. Wrap bacon around crab rolls and secure with a toothpick. Place crab rolls on a broiler pan. Broil about 4 inches from source of heat for 8 to 10 minutes or until bacon is crisp. Turn carefully. Broil 4 to 5 minutes longer or until bacon is crisp. Makes approximately 30 hors d'oeuvres.

This idea for entertaining is from a new, 22-page, full-color booklet, "Nautical Notions for Nibbling," released by the United States Department of the Interior's BCF. It is available for 45¢ from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Ask for Market Development Series No. 10, (catalog no. I-49,49/2:10).

STATES

Alaska

SURVEY SHOWS SHARP CONTRAST IN SCALLOP ABUNDANCE

The Federally aided, State-chartered exploratory fishing cruise to determine the commercial feasibility of an Alaskan scallop fishery ended June 6, 1968, at Kodiak. In 40 days of fishing, the F/V "Viking Queen" made 472 one-half hour drags using 2 standard New England dredges each 13 feet wide. She fished the area between Lituya Bay and Cape Saint Elias along the east coast of the Gulf of Alaska, the vast flats off Prince William Sound between Hinchinbrook, Montague, and Middleton Islands, along the southeast shore of the Kenai Peninsula and the entrance to Cook Inlet, and around Kodiak Island.

The Results

The cruise results indicate sharp contrasts in scallop abundance, with the dividing line near Cape Saint Elias. Eastward of Cape Saint Elias, the Viking Queen found scattered beds capable of supporting commercial operation--but none to the westward.

Over 200 drags were made in Lituya Bay-Cape Saint Elias area. Scallops appeared to be most abundant along the coast east of Yakutat Bay, where 100-bushel catches were made. Based on 6 hours' production fishing on a bed near Yakutat, Captain Ness of the Viking Queen estimates he can produce 4,000 pounds of scallop meats per day in this area with a full 11-man crew fishing round the clock.

Kodiak Catches Disappointing

The Viking Queen catches in the Kodiak area proved disappointing. Earlier landings by Kodiak fishermen suggested an apparent abundance of scallops. The Viking Queen made 110 drags around the Island from Cape Uganik to Marmot Bay--and found no large concentrations. Most drags produced few or no scallops. The Marmot Flat bed, pioneered by the "Virginia Santos," proved to be small and apparently already depleted.

* * *

HYDROLOGY OF ESTUARIES STUDIED

Small bays and inlets abound in southeastern Alaska and serve as spawning and nursery areas for many species of commercially important fish. BCF's Auke Bay Laboratory and the Alaska Water Laboratory of the Federal Water Pollution Control Administration are making a joint study of several of these bays to determine the extent and intensity of natural and man made changes in oceanographic conditions. These changes can drastically affect the biological productivity of the bays.

2 Estuarine Bays Surveyed

Two estuarine bays that are affected by pulp mill discharge were surveyed recently--Ward Cove near Ketchikan and Silver Bay near Sitka. The work is aimed at determining the detailed oxygen budget of the estuaries, mapping the bottom sediments, and measuring the effects of pulp mill discharge on the intertidal fauna. The two bays are significantly different in hydrology, and the study will provide comparative data on the susceptibility of the bays to pollution. The data from Silver Bay can also be compared with data collected in 1957 before the pulp mill went into operation.



California

1968/69 ANCHOVY REDUCTION FISHERY SEASON PROPOSED

The California Fish and Game Commission intends to adopt a 1968/69 anchovy reduction fishing season of 75,000 tons, the same as 1967/68. It scheduled a hearing in San Diego for July 26.

The proposed season would have 3 zones instead of 6. The dates would be changed from the previous season. The reason for the proposed fewer zones is that tagging studies have shown that anchovies migrate between S. California and Central California, between S. California and Baja California and inshore to offshore; thus the current zones were of little value.

Proposed Fishery

The proposed fishery would have 1 northern zone, north of Point Conception, with a 10,000-ton quota, and 2 southern zones instead of the 5 in the 1967/68 season. The total quota for the 2 southern zones would be 65,000 tons--15,000 in inshore zone and 50,000 for offshore.

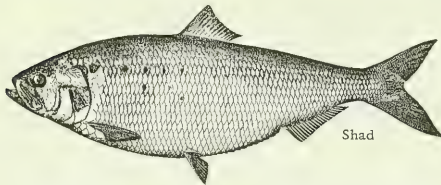
A smaller inshore quota is proposed to reduce competition in the area of heaviest sportfishing. The northern season would be August 1 through Memorial Day; the Southern from Labor Day through Memorial Day. The Department of Fish and Game recommended that the Commission consider raising the quota if commercial fishermen reach the 75,000-ton allotment during the season. It estimates the anchovy population in California waters at the minimum of 2 million tons.



Oregon

COLUMBIA RIVER SHAD NEARING CENTENNIAL

The Oregon Fish Commission has recorded the story of the nearly-century-old American shad. The fish first appeared in the Columbia River in the late 1870's. It came from a stock introduced into California's Sacramento River from the Atlantic Coast in 1871. In 1885, about 1 million shad fry from the Susquehanna and Potomac Rivers were released into the Columbia, Willamette and Snake Rivers.



Since then, the shad runs have fluctuated considerably. The bulk have spawned below Bonneville Dam. In recent years, however, dams have changed the river environment. The shad extended their range into the upper Columbia and Snake Rivers. Since 1960, annual passage over Bonneville has exceeded 200,000.

The Columbia has become one of North America's largest shad producers. The potential commercial harvest was 2-4 million pounds in recent years. Despite this abundance, commercial shad landings since 1938 have ranged from a high of about 1.4 million pounds in 1946 to a low of 136,000 pounds in 1959.

Fishing Restrictions

Before 1953, "there were no season restrictions on commercial shad fishing, although mesh size restrictions were enforced during the closed period between the spring and summer commercial fishing seasons." Since then, however, the fishery has had problems: summer chinook salmon.

In 1955, shad fishing was prohibited between normal salmon seasons except in Camas-Washougal area. This was not to "protect" summer chinook. It was designed to raise early-summer chinook escapement by eliminating incidental catch during shad season--so the regular summer commercial fishing season could begin.

The present restrictions on the shad fishery aim to protect dwindling summer chinook numbers. The restrictions began to develop after 1957, the year of the largest summer chinook run since 1938. After 1957, the run declined steadily:

1957-200,000	1964- 91,000
1958- 187,000	1965- 76,000
1959-170,000	1966- 72,000
1960-143,000	1967-No precise estimate due to early end of spring commercial fishing season.
1961-130,000	This resulted in large-scale mixing of spring and summer chinook.
1962-108,000	
1963-100,000	

Hydroelectric Installations

This decline is directly related to hydroelectric installations. These limited severely and, in some cases, eliminated races of fish by "blocking spawning runs, inundating spawning areas, delaying migrations, and creating mortalities to both upstream and downstream migrants."

The Fish Commission first became concerned about the upriver runs and the increasing interdam problems in the late 1950s. But at that time the losses hadn't seriously affected sport or commercial fisheries.

Later, the number of dams increased rapidly--and the number of fish in the upriver

runs generally decreased. By 1953, the decline in summer chinook had become serious. The Fish Commission and Washington Department of Fisheries biologists recommended a reduced 1964 summer commercial fishing season. More research in 1963 and early 1965 substantiated the summer chinook's plight. But it took a 70% interdam loss of the 1965 spring chinook run between Bonneville and Ice Harbor-Priest Rapids Dams to point up the commission's concern about problems between the dams.

In 1965, the Fish Commission and the Washington Department of Fisheries recommended no summer commercial fishing season. They requested an end of sport fisheries in Oregon, Washington, and Idaho. (The Indian fishery continued, harvesting about 9,000 summer chinook.)

Experimental Shad Season

An experimental shad season was started in 1965 at the request of the commercial fishing industry. It was limited to the upper 13 miles of the regular commercial fishing area below Bonneville Dam. To protect the summer chinook, possession of salmonoids during the fishery was prohibited.

The incidental catch of summer chinook was minimal. However, fishermen harvested only 68,400 shad from a run estimated at 700,000 fish minimum (catch plus Bonneville count).

In 1966, sport and commercial closures on summer chinook continued throughout the 3-state area. The experimental shad fishery was expanded to include 60 miles of fishing area; fishing time was extended.

Nearly 165,000 shad were harvested from the run estimated at about 700,000 (catch plus Bonneville count). However, nearly 6% of the total catch was salmon and steelhead. This increase was attributed partly to increase in night fishing, when salmonoids apparently are more vulnerable to shad nets.

Closures in 1967

The summer chinook sport and commercial fishing season closures continued in 1967. Night fishing for shad was eliminated and gear restrictions increased. Despite this, biologists found that incidentally caught salmonoids were nearly 6% of total catch. About

230,000 shad were landed. Nearly 10,000 summer chinook were caught and released. The biologists estimated, however, that 24% of the chinook were dead when removed from nets. The chinook catch was greatest during the week of highest roe shad landings.

Based on historical data and daily monitoring of shad fishery in '65, '66, and '67, biologists concluded that a maximum harvest of shad could not be taken by gill nets without catching large numbers of chinook. Also, that increased protection of chinook would be difficult because shad and chinook reach peak in fishing area about the same time.

So, on January 31, Fish Commission and Washington Department of Fisheries biologists recommended that there be no shad fishery in 1968, except in Camas-Washougal area, where few salmon or steelhead are caught. Also, research should begin in 1968 to find new ways of harvesting shad--seines, traps, etc.

Fishermen's Views

Commercial fishermen recommended that no action be taken to end the shad fishery at the January meeting. They believed they could develop gear restrictions that would virtually eliminate the incidental catch of summer chinook--and still harvest many shad. The joint commission deferred action.

At the March 27 commission meeting, industry spokesmen presented gear restrictions developed jointly by packers, fishermen, and net companies. The restrictions were to make the gill net hang in the water as a straight wall without folds or slack. With the net hung "tight," salmon would easily break through fine mesh. The spokesmen recommended a season to test the gear restrictions from June 5 to July 15 during daylight only; possession of all salmonoids was to be prohibited.

The Test

The commission later set a 4-day season to test these gear recommendations for reducing the high incidental take of chinook salmon. The season began June 10 and ran through June 13 from Gary Island upstream about 17 miles to the commercial fishing deadline 5 miles below Bonneville Dam.

Biologists monitored the fishery. They estimated the catch at 21,000 shad, 700 chinook, 44 steelhead, and 29 sockeye. All salmonoids were returned to the river.

Based on these observations and previous data, the two agencies concluded that the gear restrictions did not reduce substantially the incidental summer chinook catch--and probably reduced the shad catch. At the June 14 public hearing, they recommended no further gill-net fishing for shad in the Columbia River, except in the Camas-Washougal area.

They emphasized the need for research to develop shad fishing gear that would protect summer chinook--and be more effective in harvesting large numbers of available shad.

* * *

SHAD AND STRIPED BASS ARE TAGGED IN STUDY

Shad and striped bass are being tagged in Coos Bay by Oregon Fish Commission biologists who want to learn about the life histories of these important food and sport fish. These fishes spend part of their life cycle there. So far, several hundred have been marked with yellow plastic "spaghetti" tags.

The Commission's Charleston Research Laboratory appealed to fishermen to turn in tags with a note giving date and specific area of catch.

The study is being financed partially with Federal funds available to the state under the Anadromous Fisheries Act, Public Law 89-304.

The Commission is continuing its collection and analysis of information on the "commercial catch, fishing intensity, age composition of the runs, sex ratios, spawning history and work on juvenile ecology" on the Siuslaw, Umpqua, Smith, and Coquille Rivers.



Washington

OCEANOGRAPHIC COMMISSION SPONSORS SEAMOUNT STUDY

The Oceanographic Commission of Washington will sponsor a program to place a manned habitat and researchers on Cobb Seamount off the Washington coast in summer 1969. Called "Project Sea Use," the program calls for explorations during summer 1969 to prepare for a multipurpose ocean laboratory.

Cobb Seamount is a volcanic mountain in the Northeast Pacific Ocean 270 miles due west of Grays Harbor, Wash. It rises from a 9,000-foot deep basin to within 122 feet of the surface. It rises closest to the surface of any of the seamounts in the Northeastern Pacific, within the zone penetrated by sunlight.

Though it lies nearest to the United States it still is a basically undisturbed deep-ocean environment. Discovered in 1950, the mount has stimulated much interest. Many believe it is a regional resource with "great potential significance for scientific exploration, development of new marine engineering applications and eventual operational utilization."

Project Sea Use will seek to accomplish these objectives:

- "Characterize the chemical, physical, geological and biological features of the seamount and its environs.
- "Demonstrate that man can occupy, perform meaningful scientific work and do underwater construction at a seamount far distant from land based support and facilities.
- "Use presently available deep ocean technology in integrated support of a scientific program."



BUREAU OF COMMERCIAL FISHERIES PROGRAMS

'Undaunted' Finds Many Tunas on W. African Cruise

BCF's R/V Undaunted returned to Miami, Fla., on May 21 after a successful cruise to West Africa. (Cruise 6801, Jan. 9-May 21, 1968.) She found excellent tuna fishing throughout most of the cruise.

Open houses and press conferences were held at Freetown, Sierra Leone; Accra, Ghana; and Abidjan, Ivory Coast.

The Undaunted's missions were: 1. Investigation of the distribution and biology of surface tunas and other open-sea fishes--with measurements of the physical and biological environment. In particular, investigation of tuna distribution in the Gulf of Guinea and off Angola in relation to the oceanographic features of the Berrit Front and the Angola Dome.

2. Investigation of the distribution and biology of fishes suitable for use as live bait for tuna fishing.

3. Collection of bottom-dwelling fishes and invertebrates from the continental shelf off Angola and southwest Africa.

TUNA SURVEYS

The tuna fishing was excellent throughout most of the cruise: 88 tuna schools were sighted or detected by trolling catches. During Tuna Survey I (Feb. 18-25), 72 skipjack (*Katsuwonus pelamis*) and 3 yellowfin tuna (*Thunnus albacares*) were caught on jig lines and sampled for length, weight, sex, stomach contents, viscera, muscle tissue, and eye ball. Most skipjack were small (2-3 lbs.). Weather in the survey area (fig. 1) was excellent, and the behavior of the tuna schools sighted was judged acceptable for purse seining. The schools were not fished with live bait.

During the Frontal Survey (March 3-16) 11 tuna schools were sighted or located by trolling in 13 days. These were generally located close to the 24° C. isotherm (fig. 2). Two schools were fished using live bait. A total of 125 skipjack (2-3 lbs.) was sampled, 100 from one school. Two 35-pound yellowfin tuna were caught on sport tackle in the Baia

dos Tigres (17° S. Lat.). The bay is shallow, and the water was dirty green. The weather was generally poor with low visibility and rough seas, and tuna sighting and fishing were severely hampered.

Excellent Fishing

Numerous tuna schools, combined with excellent weather, produced excellent fishing during Tuna Survey II (April 13-26). The scientists sampled 341 skipjack and 116 yellowfin tuna from 41 schools sighted. Seventeen schools were fished, using live bait. Tuna were particularly abundant around São Tomé Island (fig. 1). As many as 6 schools were sighted in a single day. Most were small (3-5 lbs.) skipjack. Whales and birds were also numerous. One school of yellowfin tuna, averaging 12 pounds each, was worked just a few miles from São Tomé; 74 fish were sampled from this school. Most of the larger skipjack (6-8 lbs.) in the area were in advanced stages of maturity. Ovaries had large, clear eggs with well defined oil globules; the testes extruded milt on cutting and squeezing.

Most schools sighted seemed suitable for purse seining, although many skipjack were less than 4 pounds and below the size acceptable to American canners. No commercial tuna boats were sighted during the cruise, although local bait boats were reported fishing skipjack out of Lobito and Mossamedes, Angola, with good success.

BAITING RESULTS

Good quantities of bait were located at Cabo Ledo, 60 miles south of Luanda, Angola, and in the harbor at Lobito.

In 3 sets at Cabo Ledo, 150 scoops were captured. *Sardinella eba* was the most abundant species; *Chloroscombrus chrysurus*, *Ethmalosa fimbriata*, and *Trachinotus glaucus* were also present. Survival of *S. eba* was excellent, but the *Chloroscombrus* died within 3 days.

At Lobito, 150 scoops of bait, almost exclusively small (2-3") *S. eba*, were captured. Survival was excellent. Baiting was unsuccessful at Freetown, Sierra Leone, and Luana.

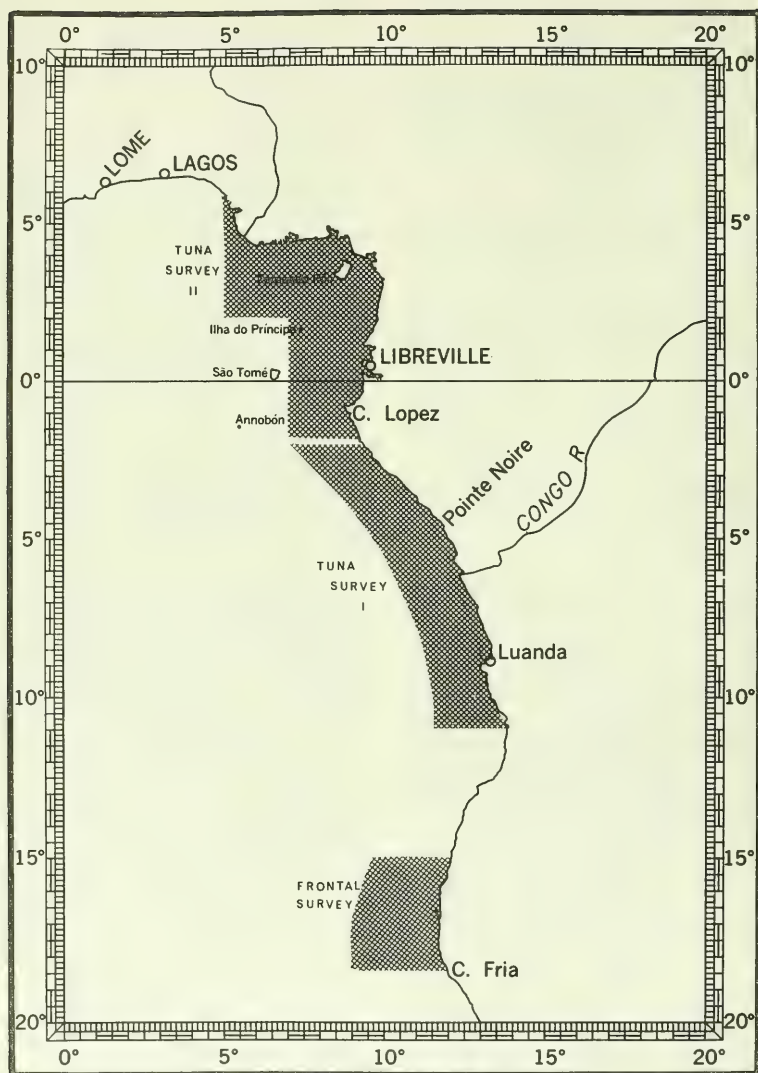


Fig. 1 - Survey areas, UN-6801.

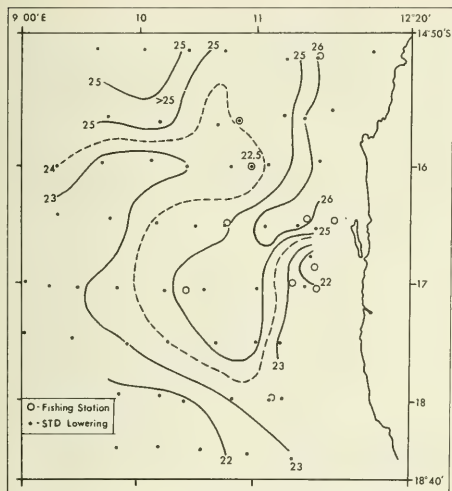


Fig. 2 - Surface isotherms, Mar. 3-Mar. 16.

FRONTAL SURVEY

After baiting at Cabo Ledo on March 2, a southerly course was followed to intercept the Berrit Front. Surface water temperature was monitored by a continuous recorder. No abrupt change in temperature was noted. At 17° S. Lat., temperature of 23.5° C., station grid was set up to survey the general area where the front was supposed to be located during this period. Oceanographic observations (temperature, salinity, inorganic phosphate, iron, and oxygen) were made to a depth of 500 m. with a salinity-temperature-depth probe (STD) and Niskin water samplers. Duplicate, oblique, 1-meter plankton net tows from the depth of the thermocline to the surface were made at all hydrographic stations. Single plankton net tows were made at all fishing stations. Primary productivity and meteorological observations were also taken.

Surface temperature plots revealed the front to be S-shaped, with the lower part beginning at about the Baia dos Tigres (fig. 2). The position and shape of the front agreed with previous observations by other workers.

TRAWLING SURVEY

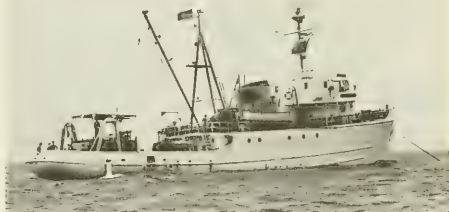
The trawling portion of the cruise was terminated after 3 days because the engine

needed repair. Of five planned transects, 1½ were completed. Seventy-five gallons of fish were preserved. Crustaceans and other invertebrates were dispensed to specialists actively working on African species.



'Undaunted' and ESSA's Weather Satellites to Pioneer Ocean Study

When BCF's Undaunted sails from Miami, Fla., on August 5 for the west coast of Africa, she will sail a charted course. But after she arrives there, she will help to pioneer an uncharted course: she will work with ESSA's weather satellites to see if data gathered by the satellites can be useful to fishermen and oceanographers in locating an oceanic "front." If the mission is successful, it could lead to the prediction of favorable fishing conditions and to larger catches.



The R/V Undaunted. (Photo: Jossi, TABL.)

The Undaunted is the first fishery research vessel to join with satellites to determine whether it is practicable to monitor oceanic fronts from the skies. Such fronts are present in some areas of the world and constitute boundaries between masses of water. The fronts seem to be instrumental in concentrating fish that school on the surface; the tuna is one of these.

The Operation

The Undaunted will use her conventional equipment to collect data on fish, the ocean, and weather conditions. In addition, she will have an automatic picture transmission (APT) receiver aboard. The satellites, orbiting the earth at about 700 miles, will transmit daily APT meteorological photos.

A single photograph by satellite could cover an area that would take an oceanographic vessel days or weeks to cover. Ordinarily, a research vessel stops fairly often to sample marine life and water. Together, the Undaunted and the satellites would be a quicker and more effective way of studying the ocean.

The Undaunted is part of BCF's Tropical Atlantic Biological Laboratory (TABL) in Miami. Dr. Paul M. Maughan of Washington, D. C., and Dr. Merton C. Ingham of TABL are BCF leaders of the project.

Undaunted's Other Missions

In addition to her work with the satellites, the Undaunted will investigate the distribution of surface schooling tunas in relation to oceanic, physical, chemical, and biological factors. She will provide specimens for biological studies. The vessel also will investigate the distribution and biology of fishes suitable as live bait for tuna fishing, and will collect bottom-dwelling fishes and invertebrates from the west African continental shelf.



Use of Traps to Capture Halibut Under Study

The charter vessel M/V "Commando" returned to Seattle, Wash., on June 10, 1968, after a 10-day halibut gear research cruise (No. 11) between Scott Islands and Hecate Strait. Due to the absence of halibut, only part of the mission was accomplished.

The cruise's major objective was to determine the feasibility of using traps, or pot-type gear, to capture Pacific halibut in commercial quantities. Other aims were to (1) compare catch rates of trap gear with those of commercial longline gear fished in the same area; (2) determine the optimum soaking time of baited traps; (3) compare suitable baits for taking halibut with traps.

Conclusion

Halibut can be captured with traps. Absence of halibut in the Goose Island area prevented evaluation of trap efficiency compared to longline gear. Therefore, the study of the effectiveness of traps for capturing halibut in commercial quantities--and the most suitable baits to use--is inconclusive.

Gear

Eight modified king crab traps 8' x 6' x 3' were covered with 9¹/₂ stretched mesh of 21-thread nylon and 2 tunnel entrances mounted on opposite sides of the trap with one fore and one aft. The tunnel entrances were mounted in 3-inch 36-thread nylon webbing. Four traps had 65-fathom buoy lines, and 4 traps had 83-fathom buoy lines. All traps had a 3-fathom trailer buoy.

Blackcod Bait

During the first 3 soaking days, cut-up blackcod inserted into plastic screen bags was used in 4 traps; cut-up herring was used in the remaining 4 traps. The bags were threaded with a steel bait hook and hung 2 bags to a trap. For the last 2 soaking days, the baits were changed to whole herring and octopus, threaded onto the bait hooks. Only herring was used as bait during the last day.

Method of Operation

Traps were set about one-half mile apart in 2 rows in 3 different locations: (1) Southwest corner of Goose Island Bank in 25-35 fathoms; (2) Northwest corner, Goose Island Bank in 52-61 fathoms; (3) between Scott Islands and Cook Bank at 52-54 fathoms. Traps were lifted after soaking 6 hours, 12 hours, and 22 hours, and were rebaited with fresh bait after soaking for 22 hours.

One skate of longline gear with 120 hooks was baited with octopus and herring and set between the 2 rows of traps. The gangion lines were spaced about 3 fathoms apart.

Results

Two halibut, 78 cm. and 108 cm., were taken in separate traps baited with whole herring threaded onto bait hooks. One large petrale sole was taken in a trap baited with cut-up herring in a plastic screen bag. No halibut were taken with the longline skate of gear or handlines. Two commercial halibut vessels were observed and only one halibut was taken during observation. No other halibut vessels were seen.

Herring Baited Traps

Herring-baited traps captured the 3 fish taken. The bait (herring) needed replacing after soaking 22 hours because small fish or

sand fleas had eaten much of it. No sand fleas were observed on or in the bait, but the appearance of the eaten bait would indicate sand fleas were present. Cut-up bait in the fine-webbed plastic screen bags was untouched by sand fleas or small fish.

Weather

Weather was generally good. The sea was choppy as northwest winds from 20-30 knots prevailed. On the last day, the sea was calm, and the large traps were brought aboard easily and stacked for the return trip.



'Cisco' and 'Kaho' Assess L. Michigan Resources

B&C's research vessels Cisco and Kaho concluded the spring 1968 resource assessment survey in southern Lake Michigan during May. (Cisco Cruises 1 & 2, 1968, Kaho Cruise 47.) Primary objective of the study was "to determine the relative abundance, condition, and seasonal movements of alewife and other important fish stocks in the southern portion of the lake."

The researchers emphasized collection of biological data on alewives during their normal inshore spawning run to better determine the

status of year class stocks; also, to monitor conditions as the summer die-off period approaches.

Besides collecting important life-history data on the alewife and other commercial species, the Kaho also sampled adult alewife populations at established stations. This was done to compare production rates with those of previous years--and to be better able to predict their availability to commercial fishermen.

Extensive echo-sounding surveys were made in southern L. Michigan to pinpoint the location of large concentrations of alewife. This information is important to fishermen who supply pet-food and fish-meal plants--and to industrial water users who have faced the problem of live alewife clogging water intakes during their spring spawning migrations.

What Vessels Found

In general, alewives were found in extremely dense concentrations, which were limited in size and moved in and out of an area. Commercial trawlers provided evidence of scattered and mobile concentrations reflected by daily catches. For a day or two, catches were exceptional, then the following day or two produced moderate or very poor catches. Catch rates of adult alewife with the Kaho's standard 52-foot (headrope) trawl were

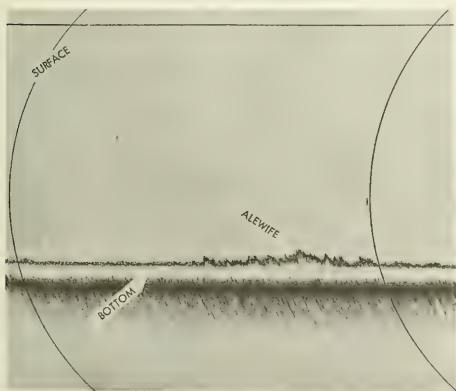


Fig. 1 - High-resolution "white line" echo sounder recording (left) showing alewife concentration on the bottom in 20 fathoms of water off Waukegan, Illinois, on April 13, 1968. Some 11,000 pounds of alewives (right) were taken in a 15 minute trawl drag which was in this concentration about eight minutes. Note that concentration of alewives was so dense that top of school produced "white line" effect which usually is caused by the bottom only.

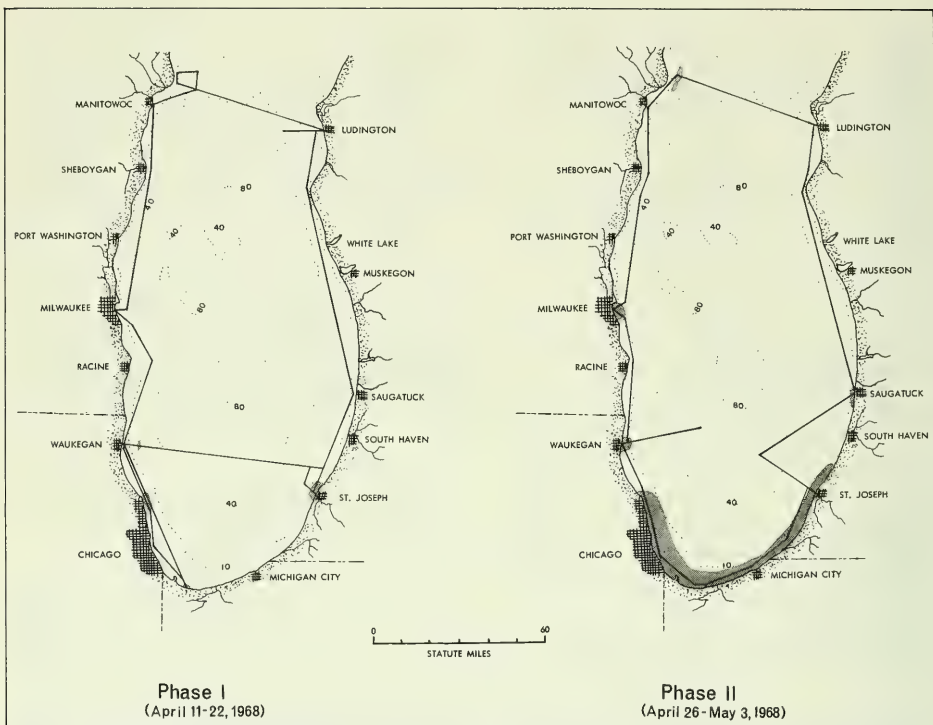


Fig. 2 - Track lines of the resource assessment echo-sounding and sampling surveys by R/V Kaho during April and May 1968. Shaded areas indicate bottom concentrations of alewives.

roughly comparable to those in 1963 and 1964. Sampling with a standard small-mesh trawl by both Cisco and Kaho on both sides of the lake revealed extremely abundant yearling alewife (1967 year class).



'Delaware' Finds Many Northern Shrimp

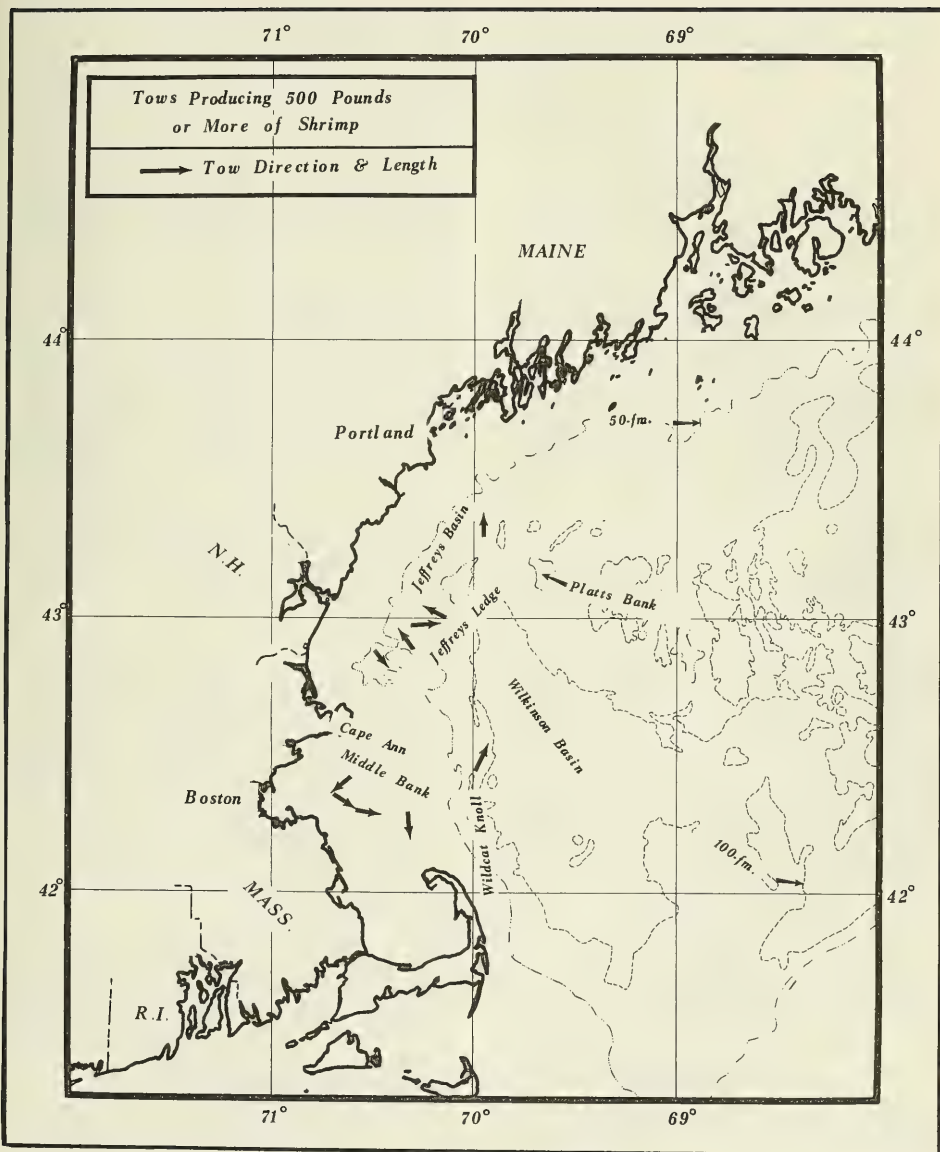
Extensive populations of northern shrimp (*Pandalus borealis*) were found in waters of the western Gulf of Maine.

BCF's Delaware returned to Gloucester, Mass., on May 17 after a spring resurvey for shrimp in areas explored Nov.-Dec. 1967 and Jan.-Feb. 1968 (Del. 68-4, May 8-17, 1968).

The survey area extends in a north-south direction from the southeast end of Cape Cod to Jeffreys Basin, and in an east-west direction from the western edge of Wilkinson Basin to Middle Bank. Trawl tows were made in 40 to 140 fathoms; catch size varied from one to 1,300 pounds of shrimp. The size varied from 33 to 50 whole shrimp per pound. This was the last in a series of three cruises scheduled for the 1967/1968 season.

Purpose

This cruise was conducted to (1) recheck shrimp populations and distribution in areas previously surveyed; (2) determine kind and extent of any population changes that may have occurred, and their effects on the availability of shrimp to commercial fishing in this area



Delaware Cruise 68-4, May 8-17, 1968.

at this time of year; and (3) collect biological data pertinent to possible commercial utilization of this resource.

Procedure

During the cruise, 51 tows were made. All were with a roller-rigged, 70-foot, Maine shrimp trawl. All were 60 minutes except 2 shortened ones. These two were terminated early when a hang-up occurred soon after the hook-up for one tow, and when the nature of the bottom became untrawlable after 40 minutes of the other tow.

Fishing operations began on the western tip of Stellwagen Bank and progressed northward along the western edge of Wilkinson Basin to about the latitude of Platts Bank. Fishing then continued southward along the northeastern side of the Basin to between Fippennies Ledge and Sharrer Ridge. From this point, the survey continued off the southeast end of Cape Cod and then progressed into Jeffreys and Scantum Basins.

Results

Most shrimp taken were in a soft condition and probably were not optional for commercial utilization.

Of the 50 completed tows, all caught shrimp. The average catch per tow was about 276 pounds of shrimp. Ten tows (20 percent of total) produced catches of 500 pounds or more. While this catch rate would certainly sustain commercial fishing, it is somewhat lower than the results of the winter cruise, Jan. 6 to Feb. 7, when about 30 percent of tows in this area yielded at least 500 pounds. However, these results were better than the fall cruise's, when 14 percent of tows took over 500 pounds. Catches from night tows were considerably smaller than day tows; so night fishing for shrimp with existing gear in these areas is not recommended at this time.

Two catches of over 1,000 pounds per tow were made near Stellwagen Bank (Middle Bank) in 40 to 50 fathoms. All tows in this area produced good catches; they averaged 900 pounds per tow for the 4 made. One 700-pound tow, in location that previously produced only small catches, shows that shrimp had moved into this section since the winter cruise. Otherwise, shrimp populations on Middle Bank generally appear to be about

the same now as during the winter season. However, the size of the individual shrimp was somewhat smaller than then.

The most noticeable change in shrimp populations was in Wilkinson Basin. Only one of the 27 tows produced 500 pounds or more. This compares poorly with winter survey, when 14 of 40 tows produced this quantity. The one exceptional tow, a catch of 800 pounds, came from Wildcat Knoll. In the Basin area, the size composition of catches was smaller than during the fall and winter surveys.

In the Jeffreys-Scantum Basin areas, shrimp populations were rather large and extensive. Four of the 8 tows produced 500 pounds or more. This compares well with results of winter survey and indicates little change in population and distribution of shrimp in these 2 sections. Here, as in Wilkinson Basin, shrimp size generally was smaller than during previous 2 cruises. Many small shrimp were observed escaping from forward sections and cod end of the trawl as it was hauled aboard. For the first time in any of our surveys, Pandalus montagui (a smaller species of pink shrimp), was taken in noticeable numbers from this and Middle Bank area.

Other Species

Finfish generally were abundant in all areas fished and were easily separated from the shrimp by the Base-designed mechanical shrimp-fish separator.

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



La Jolla Issues Temperate Tuna Forecast for 1968

BCF's Fishery-Oceanography Center in La Jolla, Calif., has issued the eighth consecutive annual prediction for the summer season albacore and bluefin tuna fisheries off the Pacific Coast.

The 1968 forecast was made 3-4 weeks later than in previous years.

The staff of the Fishery-Oceanography Program explains the change in prediction date and outlines its forecast:

The delay in issuance of our predictions arises from experience accumulated during the past 8 years. This showed that prediction techniques once thought valid have not withstood the test of time satisfactorily. Our prediction techniques were based on the expected persistence of large-scale sea-surface temperature anomaly patterns. Consequently, the offshore thermal trends observed in April of each year were assumed to persist at least through July. Last year, this assumption failed; the abnormally cold conditions observed in April 1967 were the basis for our predicting a late, more southern, fishery than in 1966. Later, intense early-summer warming completely overtook the previous cooling trend. By July 15, abnormally warm conditions were established in the Pacific Northwest and persisted for the remainder of the season. The albacore responded rapidly to these dynamic changes, producing near-record catches off Oregon and Washington, while California experienced very poor fishing.

A New Approach

This experience dictates that we alter substantially our approach to the 1968 season. One major change will be the temporary suspension of long-term quantitative landings and area forecasts. A second will be to make heavier use of short-term projections of conditions based on current information issued in the form of outlooks and occasional bulletins. These bulletins, well received last year, will include: changes in oceanographic and atmospheric trends; changes in location of productive fishing areas; changes in total fishing effort; and other data pertinent to the fishing community. As before, the success of these operations depends necessarily on the input of first-hand information from the fishermen at sea, dock operators, and processors. We continue to be hampered by a scarcity of such timely information.

ALBACORE TUNA

The basis for depicting the shaded areas in Figure 1 is previous knowledge of the high correlation between catch and sea temperature--combined with an 8-year experience in observing and summarizing sea-surface temperatures at 15-day intervals from April to October. The isotherm fields for the first and second halves of July represent our long-term averages for each interval. The shaded areas delineate the region where, on the basis of sea temperature averages, most albacore

would be available in July. Since prevailing weather and sea temperature patterns may deviate considerably from these averages during the period, we will modify and update our projections as conditions indicate. These projections will be forwarded to the fishing community as soon as practicable.

Preseason Scouting Minimal

Preseason scouting activities will be minimal this year. The usual May-June offshore scouting cruise by California's "N. B. Scofield", undergoing overhaul, was cancelled. This resulted in substantial reduction of our ability to make early-season judgments based on data she normally acquired. BCF's "David Starr Jordan" first reported taking 4 albacore near San Juan Seamount (33° N., 121° W.) on June 12. This catch is the first authenticated report available this season. It suggests the fish may be arriving on the Pacific Coast feeding grounds up to 2-3 weeks earlier than in the past 3 years.

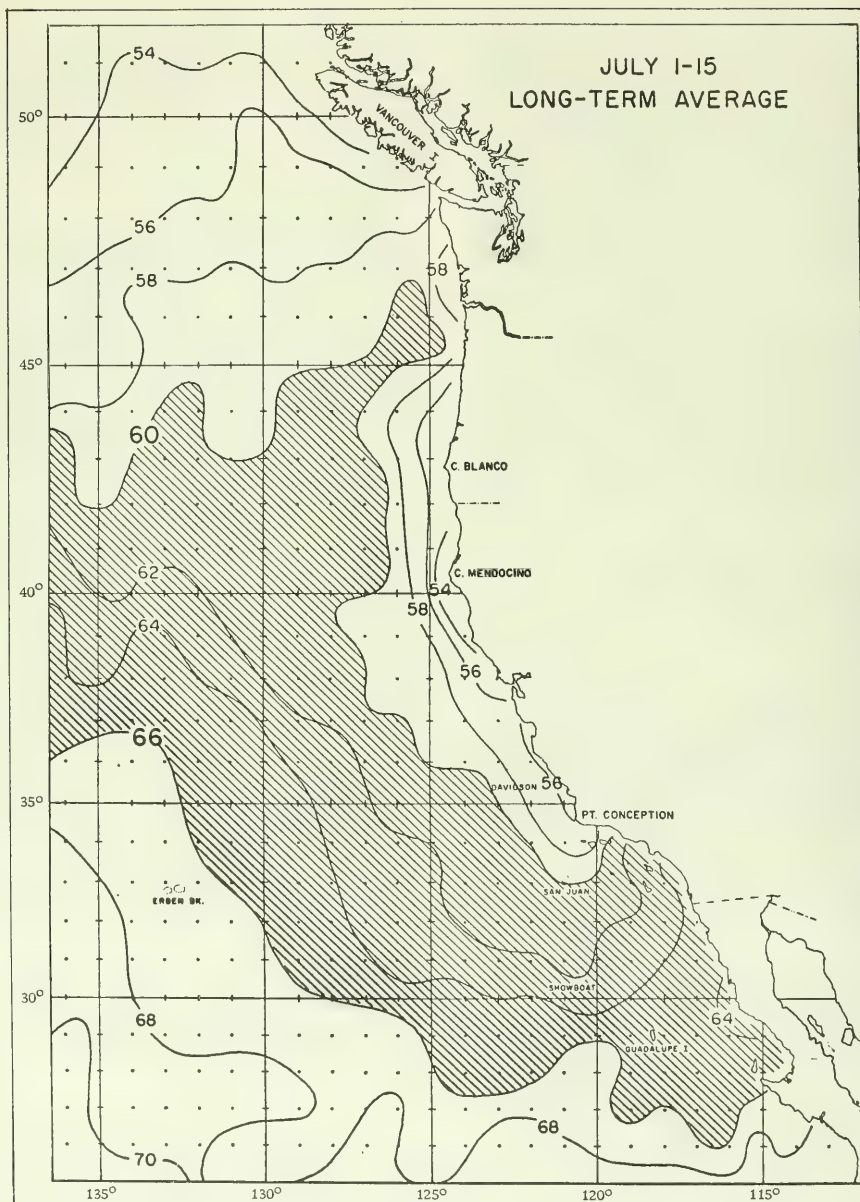
The open ocean in the region encompassing the general migratory route of albacore (130°-150° W.) showed large-scale warming trends in late May and early June. If the warming trend continues, we expect to see an appreciable portion of the incoming migrants diverted into northern waters instead of southern California. The Guadalupe Island area and the region to the northwest may produce some early-season catches, but we expect the fishery to advance rapidly northward from San Juan Seamount to west of Davidson Seamount by the end of July.

July landings in southern California should reflect a return to more normal conditions. The landings should be near the 1940-66 average of about 6,600,000 pounds (3,300 tons). Total California season landings cannot yet be estimated, but we expect they may also fall near the 1940-66 average of 30,000,000 pounds (15,000 tons).

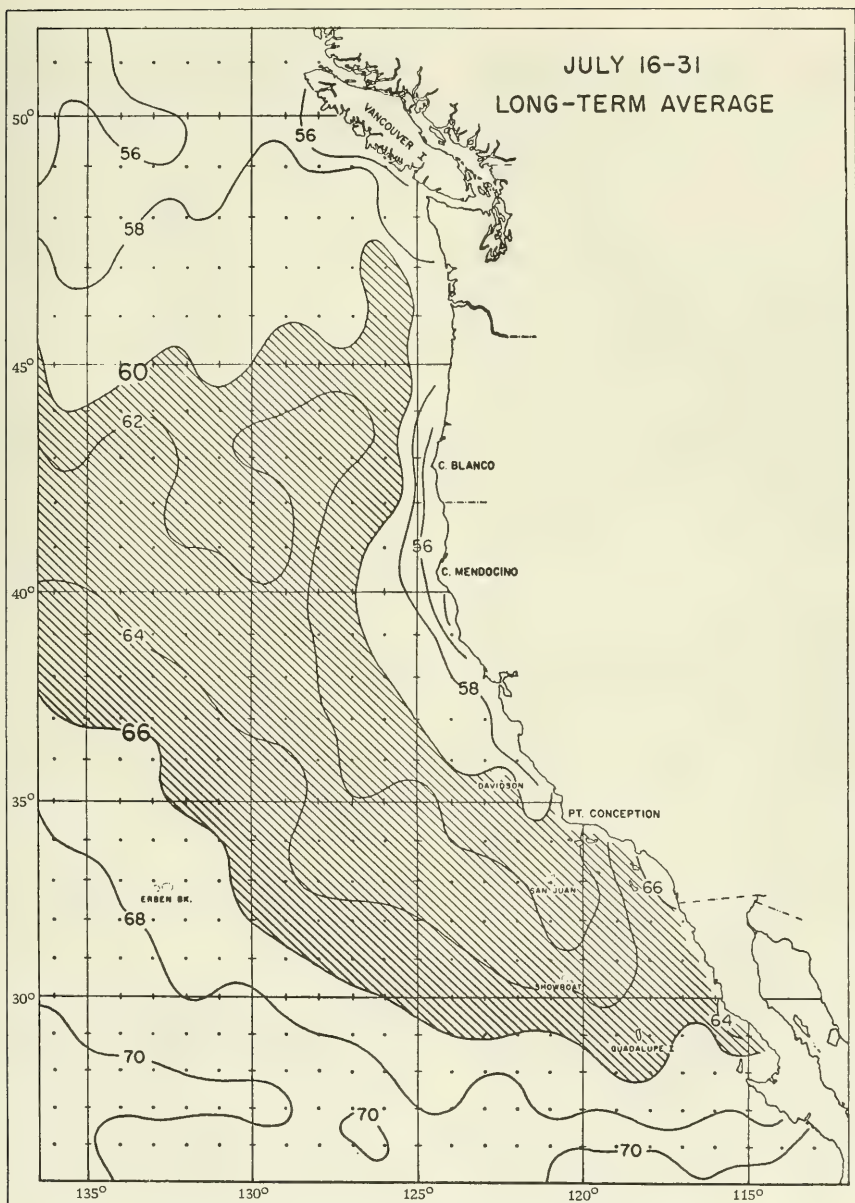
The Oregon-Washington region is expected to receive a significant portion of the total U. S. West Coast albacore production this year. But total landings are expected to fall somewhat below 1966-67 levels.

Preseason Scouting Valuable

The Jordan's recent early-season albacore catch continues to demonstrate the value of preseason scouting cruises to determine the arrival time of the albacore tuna in Pacific



Average sea-surface temperature fields for the July 1-15 and 16-31 intervals. Shaded



zone delineates region where most albacore would be available under these conditions.

Coast offshore waters. Even if successful forecasting of environmental conditions were possible, knowledge of these trends would not necessarily enable us to predict availability of the fish in time and space. Without more life history and other vital statistics from the entire North Pacific albacore population, we can make only certain conclusions based on other sources.

The Jordan is scheduled to survey the northern California-southern Oregon offshore region from July 15 to August 16. Major objectives will include establishing the distribution and availability of albacore in offshore waters during the middle of the Pacific coast season; also, to test prospects for commercial exploitation of albacore beyond the traditional limits of the fishery (about 300 miles). During the cruise, pertinent information will be radioed daily to WWD, the radio station licensed to BCF, for rebroadcast as part of the daily albacore fishing information summary. The information gained from the Jordan should be of prime value to fishermen and processors in updating midseason projections this year.

BLUEFIN TUNA

The high-seas purse-seine fleet intensified scouting in the Cape San Lazaro-Cape San Lucas, Baja California offshore region. Boats returning from the yellowfin fishing area south of Cape San Lucas reported sighting in the past 2 weeks bluefin "jumpers" in cold, green water near Cape San Lucas and northward to near Point Tosco. Also, one sportfishing boat recently reported taking a few 10-15 pound bluefin in the Guadalupe Island area, about 400 miles to the northwest.

In recent years, bluefin fishing activity began in lower Baja California by the last week of May. This year, however, the fishery was expected to develop later than usual because of significant changes in climatological events in that region. Lower Baja California has experienced a spate of strong northerly winds. The heavy weather created has severely limited fishing activity and caused greatly intensified upwelling. This upwelling created a nearshore band of considerably colder than normal sea temperatures and green water. These events combined to delay the onset of the fishery well into June; they may cause the bluefin to remain farther offshore than usual.

One consequence of the delay will be a northward shift in the center of production--and a delay in the period of maximum production. Rapid warming in the region north of Guadalupe may cause bluefin tuna to appear earlier than last year in southern California offshore waters.

Meaningful estimates of total 1968 bluefin landings are not available. We have no data on which to make projections of abundance.



'Spaghetti' Tags Outline Alaskan King Crab Grounds

Since 1961, biologists of BCF's Auke Bay (Alaska) Laboratory have been capturing, tagging, and releasing thousands of male Alaskan king crabs. Their purpose is to find out how many there are and where they are distributed in the Kodiak Island and Eastern Bering Sea areas. Also, they are trying to estimate how many die a natural death and how many are caught. These and other data will help determine conservation measures.

While the crab's size makes it troublesome--it averages 7 pounds and its walking legs reach 24 inches--the real problem is finding a tag that will stay on.

In the past, a tag shaped like a disk was used to trace crab migration during one season. The disk, attached to a leg or the edge of the shell covering, would come off with these parts during the molting season.

Long-Range Study

To conduct a study through one or several molting seasons, researchers use a "spaghetti" tag. It is plastic tubing put through muscle tissue under the shell and looped.

Fishermen and processors receive \$2 for each tag returned to the Auke Bay Laboratory. Of nearly 17,000 tagged crabs released near Kodiak Island, 6,443 (38 percent) of the tags have been turned in with information on crab size and when and where they were recovered.

In the past 20 years, the U. S. catch of Alaskan king crab has soared--from 1.5 million pounds in 1950 to 1966's high of 159.2 million pounds.

In late 1964 and early 1965, Japan and the USSR agreed not to fish for U. S. stocks of king crab except in the eastern Bering Sea. Quotas for this area are negotiated annually. There was agreement, too, on type of gear that may be used and size and sex of crabs allowed to be taken. At present, only males with over $5\frac{1}{2}$ -inch body width may be kept.



Fast-Sinking Purse Seine Developed

BCF has developed a fast-sinking purse seine that will provide tuna fishermen with more efficient gear. The new net retains the desirable features of the tuna purse seine now used in the eastern tropical Pacific--but will sink faster and use webbing with greater economy. The importance of a net sinking fast is illustrated by the fact that about 50 percent of purse-seine sets for tuna are unsuccessful because fish escape the net during setting and pursing operations.

The net was developed by BCF's Fishery-Oceanography Center in La Jolla, Calif., in cooperation with the BCF Exploratory Fishing and Gear Research Base in Seattle, Wash.

The Conventional Purse Seine

The purse seine in use today is a large encircling net with a closable bottom. It is one of the fisherman's most effective instruments for capturing mobile, dense schools of open-sea fish. Throughout the world's oceans, fishermen use purse seines to take fish ranging from small anchovies and sprats to huge bluefin and yellowfin tuna. In the U. S. alone, in recent years, more than 1 million metric tons of fish worth over \$75 million have been caught annually with purse seines.

About 50% Efficient

Despite the growing importance of purse seining, researchers made few attempts to improve the net's catch efficiency of about 50 percent. The proportion of unsuccessful sets increases with the depth and nature of the thermocline--the zone of water in the ocean where there is a rapid change in temperature with depth. Biologists theorized that if tuna purse seines could be made to sink faster and fish deeper, efficiency would

improve. It was estimated that only a 10 percent improvement in the rate of successful sets would reduce operating costs for the U. S. tuna fleet by more than \$1 million annually.

Attacking the Problem

A comparative study of the design and performance of various purse-seine nets was undertaken at BCF's Fishery-Oceanography Center. Several scaled-down models were built and tested. Evaluation of the data revealed that the best net for fishing tuna should be a combination of the fast-sinking North Atlantic purse seine with the strength, deep fishing, and ease of handling of the American tuna seine. A model hybrid purse-seine net incorporating desirable design elements was built and tested. Results of the model tests were so encouraging that in spring 1968 the Center, in cooperation with the Seattle Base, undertook construction of a full-scale net, 460 by 55 fathoms, in a San Pedro net yard.

Net Ready for Trial

The net is now ready for sea trial. Several vessel owners have offered to participate. The trials will consist of 2-3 days of routine net handling, including setting, hauling, and stacking, to determine if any special handling techniques must be devised or net modifications made. At the same time, bathythermograph data on net depth and sinking rate will be collected. This will be followed by fishing trials during the summer.

If the net performs as promised, and the California purse-seine fleet accepts it, tuna fishermen will have more efficient gear.



Antibiotics Improve Algal Food But Somewhat Toxic to Oyster Larvae

Microscopic examination of oyster larval cultures in studies conducted by BCF's Milford (Conn.) Biological Laboratory confirmed earlier evidence that poor food cultures will improve significantly when antibiotics are added. In all instances, the percentage survival of oyster larvae fed flagellates plus antibiotics was higher than oyster larvae fed flagellates without antibiotics.

Somewhat Toxic

When algal culture is an acceptable food (larval survival is good), then antibiotics do not help appreciably. When algal culture is an unacceptable food (larval survival is poor), then antibiotics can increase larval survival significantly. These experiments also showed that the antibiotics used were toxic, to some degree, to the oyster larvae.

The researchers say it would be desirable to increase larval survival using antibiotic concentrations that did not retard larval growth. Although it would be possible to compensate for the growth-suppressing effect of antibiotics by prolonging culture time, this undoubtedly would be an undesirable hatchery procedure.



Sea-Surface Temperature Affects Success of Net Sets

Michael Scott, fishery biologist at BCF's Fishery-Oceanography Center at La Jolla, Calif., examined over 2,000 records of purse-seine sets from logbooks of U. S. tuna fishermen. He related these sets to sea-surface temperature. He found a significant negative correlation between the temperature and the percent of successful sets. Only 47 percent of sets made on bluefin at a water temperature of 70°-76° F. were successful, while 64 percent of sets at 59°-65° F. were successful.



Lab to Develop Feeds for Navy's Trained Porpoises

BCF's Seattle Laboratory won a small contract from the Naval Test Facility at Pt. Magu, Calif., to develop suitable feeds for the trained porpoises that are important part of the Navy's Man-in-the-Sea program.



These studies will include the nutritional value and appetite appeal of fish feeds--and the problems of feed formulation and storage.



Turtle Grass Added to Sheep Ration Stimulates Growth

Studies by BCF's College Park (Md.) Technological Laboratory and the Biological Laboratory in St. Petersburg Beach, Fla., indicate that turtle grass added to sheep ration stimulates the animal's growth. There are large areas of turtle grass in the waters off southern U. S. Feeding trials were carried out to determine if it was practicable to use the grass in sheep rations.

Turtle Grass Beneficial

The trials showed that a ration of turtle grass replacing 20% alfalfa in a sheep diet produces a significant increase in rate of sheep growth--compared to the effects of a control diet of 50% alfalfa and 50% corn.

The turtle grass has flat, narrow leaves originating from a rhizome system (rootlike stem sending up leafy shoots from upper surface and emitting roots from lower side). When leaves are cut, regrowth begins immediately. This indicates material can be available all the time without harming plant. Regrowth occurs at rate of about 1 inch a week.



Shipping Test of New Container Is Successful

BCF's Gloucester (Mass.) Technological Laboratory, which recently designed a leak-proof, corrugated fiberboard container, test-shipped 35 containers of its design in late May. It had been asked by the National Fisheries Institute for additional data under commercial conditions. The Institute supplied 250 containers.

The lab shipped by air freight the 35 boxes containing fresh fillets and wet ice from a Gloucester processor to a Chicago food chain. A representative of the box manufacturer reported that the container performed satisfactorily. He said store personnel preferred the boxes because they were cleaner and more convenient to handle than wood boxes.

Excellent at Arrival

The fillets were warm (50° F.) when packed. An unscheduled 24-hour delay developed in route. However, the fish cooled to 33° in transit and were reported in excellent condition when they arrived.



Interest on Fishery Loans Raised

Starting July 1, Government interest rates on fishery loans became 6½ percent. Fishery loans may be authorized to finance or refinance the cost of buying, building, equipping, maintaining, repairing, or operating commercial fishing vessels or gear--when funds are not available on reasonable terms elsewhere.



Mortgage Insurance Rules Changed

BCF has announced changes in regulations governing interest rates on fishing vessel mortgages insured by the Department of the Interior. The new regulations are designed to make the rates charged more flexible. They should make it easier for fishermen to get these loans.

Under previous legislation, there was a 6-percent interest ceiling on such loans. In the past few months, there was a general rise in interest rates. This caused most lenders to push aside requests for fishing vessel loans in favor of others bringing a higher return.

Law Amended

The law covering insured fishing vessel mortgages has been amended. It now permits Interior Department to determine the interest rate to charge--taking into account the risk assumed by the Department, and the private interest rates at the time of the loan.

Mortgages to finance building, rebuilding, or reconditioning fishing vessels can be insured by Interior Department in the way the Federal Housing Authority insures mortgages to finance home building.



Promotes Lesser Known Fishery Products in Europe

Some lesser known U. S. fishery products will make their debuts at European trade fairs this fall: fresh and frozen eel meat, frozen fish chowder concentrate, haddock and cod portions shaped like hot dogs, frozen carp. BCF will sponsor exhibits at the Munich Fair, Sept. 21-29, and the Paris Fair, Oct. 24-Nov. 4.

Most of the world's major food producers and processors will display their products. Buyers from all over Europe will attend. In previous fairs, U. S. fishery displays concentrated on gourmet items--lobster, king crab, oysters. This fall some lesser-known U. S. products will be shown. Many of these are processed by small firms reaching across the ocean for the first time.

Industry Is Invited

U. S. producers and processors are invited to display their products at both trade fairs. With BCF personnel manning the exhibits, the firms will not have to send representatives. The number of U. S. participants will be limited to available space on a "first come-first served basis."

For more information, contact Office of International Trade Promotion, Bureau of Commercial Fisheries, 1801 N. Moore Street, Arlington, Va. 22209. Telephone: Area Code 703-557-4731.



Thai Fisheries Officer Visits Milford Lab

Tomoron Tangkulsen, a fisheries officer from Thailand, recently spent a week at BCF's Biological Laboratory at Milford, Conn. He is studying the techniques for spawning and culturing larval shellfish. Mr. Tangkulsen also observed oyster harvesting operations and the use of predator control gear in Long Island Sound.

And Visitors From Oregon

The lab also received visits by Dr. William Breese, Oregon State University Marine Laboratory, and Dale Snow, Oregon Fish Commission. They are planning a shellfish hatchery to be built in Oregon.



BCF Labs Aid College Students

During the past semester, staffs of BCF laboratories across the Nation continued their practices of inviting students to visit, lectured on phases of their research, and took their visitors on cruises to observe natural phenomena or to collect specimens.

The following were representative sessions:

At Oxford (Md.): A class of 44 students from Hiram College in Ohio spent 3 days in concentrated field research and study. Field trips were made on BCF's research vessel "Alosa" under the direction of laboratory scientists. Staff members lectured on various aspects of marine biology to the students and their professor. Temporary classroom laboratories were set up in beach-front buildings of the laboratory.

At La Jolla, Calif.: Dr. Reuben Lasker, Assistant Director of BCF's Fishery-Oceanography Center, lectured to 55 oceanography students and 16 faculty members from the University of Baja California at Ensenada. He also showed the group the Center's facilities.

The students' visit to the Fishery-Oceanography Center and to the Scripps Institution of Oceanography is an annual event. It is sponsored by the Oceanids, a women's group at the University of California, San Diego.

At Milford, Conn.: The lab continued its cooperative program with colleges and universities in the New England area. Staff members spoke to biology classes from the University of Massachusetts and Southern Connecticut State College on research being done at the lab. Each group was taken aboard the "Shang Wheeler" to collect invertebrate specimens in Long Island Sound.

Maria Panciera and John Manzi spoke at their old Alma Mater, Southern Connecticut State College, the former on her study of quahog culture, the latter on oyster drill biology.



Emergency Water Pump Available for New England Demonstration

BCF's Fishing Vessel Safety Unit has a new-type emergency water pump available for inspection and demonstration to fishermen along the New England coast.

This is the pump used by the Coast Guard in search and rescue operations involving commercial fishing vessels. In 1967, 38 fishing vessels from Maine, Massachusetts, and Rhode Island received the pumps--by helicopter lowering, a plane drop, or transfer from a Coast Guard surface vessel.

The Bureau is eager to show interested groups of fishermen how the unit is operated in pre-emergency sessions.

For further details, write to BCF Safety Unit, 408 Atlantic Ave., Boston, Mass., 02210, or phone 617-223-7748.



Marketing Services Chief Wins Golden Chef Award

Bob Finley, Chief, National Marketing Services Office, BCF, Chicago, won the Golden Chef Award from the Executive Chef's Association. The award was given to him for significant contributions to the culinary arts by promoting the increased use of fish and shellfish.

Finley has been asked to accompany the American Culinary Olympic team to Frankfurt, Germany, for the international competition. He helped judge this year's U. S. competition. The team will demonstrate and feature American seafoods on the continent in a gourmet manner.



ARTICLES

VACUUM EVISCERATION

A Modern Method of Cleaning Fish at Sea

By Thomas J. Connors* and Daniel W. Baker**

Modern methods of handling fish are largely absent from the fishing vessels. In New England off-shore fishing, laborious traditional methods of handling fish on board may have been adequate in the past, but under modern standards of efficiency, product quality, and sanitation, greatly improved methods of handling are needed.

One operation in the fish-handling system that requires improvement is the evisceration of fish. The current practice necessitates teams of 3 men--usually, one ripper and two gutters per team. The work is generally done on the deck, which does not always present a clean, safe, work area because fish and offal accumulate underfoot. This inefficient operation is the major factor in determining crew size.

The Bureau of Commercial Fisheries Technological Laboratory at Gloucester, Massachusetts, has developed, as part of an overall automated handling system, a prototype vacuum eviscerator. This paper compares the new with the present system and outlines the advantages of the new system.

THE PRESENT METHOD

The evisceration of fish on board a large off-shore trawler usually requires two 3-man teams, each team composed of a ripper and 2 gutters. The fish taken in a trawl are dumped on deck. The net is put over for the next tow. Then the rippers stand among the fish, in a tiring bent-over position, select fish, and rip open the visceral cavity with a knife. They then toss the fish to the deck outside the checker, where the gutters remove the viscera by hand, throw the fish into a wash box, and drop the offal to the deck. Here the boat's motion and the wet deck result in mixing ripped fish with viscera. Efficiency, cleanliness, and safety are sacrificed under these tiring and dangerous conditions.

The efficiency of this method was measured from films taken on board a commercial trawler during normal fishing operations. Under normal working conditions, about 16 fish (weighing an average of 2.5 lbs.) can be ripped, gutted, and washed in 1 minute. Hence:

$$\frac{16 \text{ fish/min.} \times 60 \text{ min./hr.} \times 2.5 \text{ lbs./fish} = 400 \text{ lbs./hr./man}}{2 \times 3 \text{ men}}$$

VACUUM EVISCERATION

To determine the productivity of the vacuum eviscerator, we made a time study at the Gloucester Laboratory. Figure 1 shows a diagram of a single mechanically operated vacuum pump and tank. Since a number of such stations can be operated from a single pump and tank, the number of stations would be limited primarily by the size of the vessel and crew. This equipment offers flexibility by permitting the combination vacuum tank-trap to be located anywhere on the vessel, so it does not interfere with normal fishing operations. The vacuum evisceration device then can be connected to the central suction head by a flexible hose allowing the catch to be processed where dumped; it eliminates unnecessary handling. This equipment can be adapted to operate with any reserve power a vessel may have.

Figure 2 shows the sequence of operation of the valve linkages. After the operator pushes a fish onto the interchangeable nozzle, shown in Figure 1, he depresses the foot pedal to open the vacuum valve (b), and the vacuum pulls out the viscera, which it then deposits in the vacuum tank-trap. By further depressing the foot pedal, the operator closes the vacuum valve and simultaneously opens the water-flushing valve (c). When water overflows the visceral cavity, he releases the foot pedal part way to position B, closing the flushing valve and opening the vacuum valve, instantaneously removing the flush water.

*Research Chemist

**Mechanical Engineering Technician

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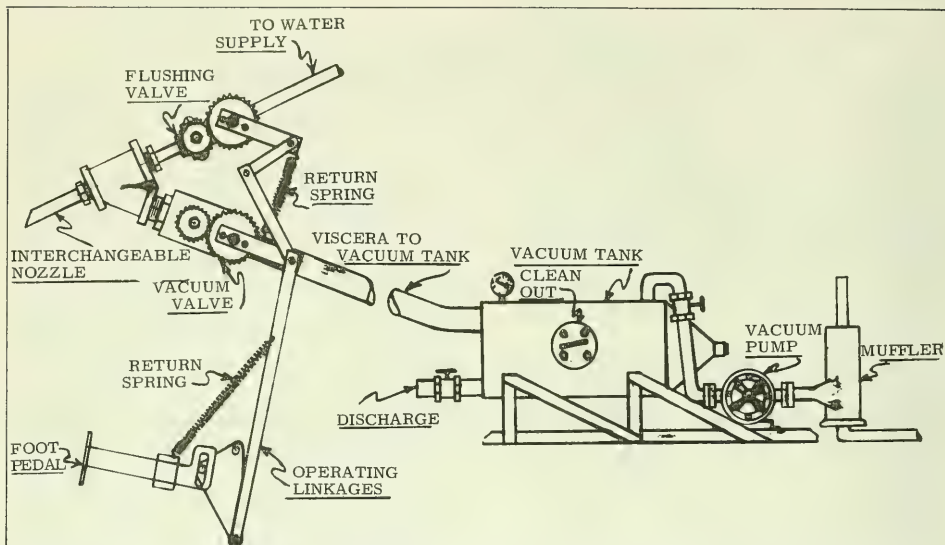
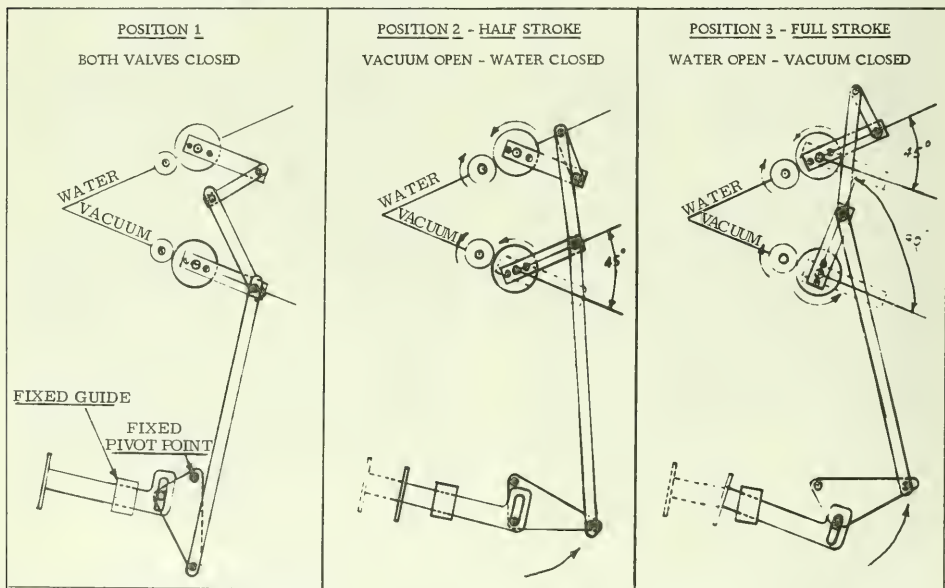


Fig. 1 - Semi-automatic prototype vacuum eviscerator and flushing device for cleaning the visceral cavity of fish.



Valve operation is sequential through operating linkage. Valves are gear operated through ratio of 2 to 1. 45° rotation of large gear rotates small gear 90° for full opening of ball valve.

Fig. 2 - Schematic of linkage for valve operation of vacuum eviscerator.

When he completely releases the foot pedal, he closes the whole system, as in (A), leaving it ready for the next sequence.

At a more advanced stage of development, the entire sequence can be made completely automatic and adapted to the special needs of individual vessels.

In measuring the performance of vacuum evisceration, we found that a fish could be cleaned and flushed in about 10 seconds during continuous operation. Thus, one man can eviscerate and flush:

1 fish/10 sec. X 3, 600 sec./hr. X 2.5 lbs./fish = 900 lbs./hr./man

ADVANTAGES OF VACUUM EVISCERATION

Vacuum evisceration and flushing provide these advantages:

1. The crew size of larger vessels can be reduced by 3 men, resulting in more income per man. Also, this mechanization releases to other vessels experienced men, who are in short supply.

2. The equipment can be placed in such a manner that the men can work in a convenient

sitting or standing position, instead of a tiring, bent-over, position.

3. Safer working conditions can be provided because no fish or offal would be deposited on deck causing dangerous, slippery footing.

4. Bacterial contamination can be reduced because the fish do not have to be cut. Also important, the visceral contents are effectively removed from the processing area. The quality of fish landed in port should therefore be improved.

5. The landing of higher quality fish can result in economic advantages, which benefit both industry and consumer.

NOTE ON INSTALLATION AND OPERATION

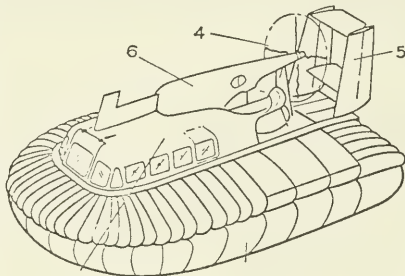
Because of our limited knowledge of the costs of equipment, fabrication, and services, we can only estimate the cost of the vacuum eviscerator. We believe it would be in the order of \$5,000. Although the prototype was tested at sea, it has not been used for any extended period. We therefore cannot estimate down times and maintenance costs, but present indications are that these units will be relatively trouble free.



INFLATABLE SKIRTS FOR HOVERCRAFT

An inflatable skirt that allows hovercraft a large area of supporting air cushion when they operate, but needs only a small storage area, has been patented in England.

The invention provides a skirt, held up by inflatable members, that extends laterally from the rigid base of the craft's body and increases the area of the trapped air cushion on which it hovers. With the retractable skirt, hovercraft can be designed with rigid bases small enough to be carried as lifeboats on the deck of larger vessels and yet have air cushions large enough for efficient riding when they operate. (Reprinted with permission from "Science News," weekly summary of current science, copyrighted 1966 by Science Service, Inc.)



SCALLOP EXPLORATIONS OFF OREGON

By Lael L. Ronholt* and Charles R. Hitz*

BCF's exploratory fishing vessel "John N. Cobb" conducted two surveys for the weathervane scallop (*Patinopecten caurinus*) off Oregon, one in 1963, the other in 1967. The primary fishing gear was an 8-foot, New Bedford-type, scallop dredge.

In 1963, greatest concentrations of scallops occurred between Tillamook Head and Cape Falcon, Oregon, in 53 fathoms. Catch rates reached 753 scallops (5 bushels) per $\frac{1}{2}$ -hour tow. But, when this area was fished again in 1967, catch rates reached only 10 scallops per $\frac{1}{2}$ -hour tow. The best catch in 1967 was 118 scallops per $\frac{1}{2}$ -hour haul off Sand Lake, Oregon, in 55 fathoms.

The first survey began Sept. 30, 1963, and lasted 7 weeks. It explored the grounds from Cape Arago to Heceta Head, from Alsea Bay to Yaquina Head, and from Cape Falcon to the Columbia River at depths from 28 to 65 fathoms (fig. 1).

The second survey, a 3-week cruise, started March 6, 1967. Hauls that had been made off Tillamook Head in 1963 were duplicated, and hauls were made over unsurveyed grounds between Cape Falcon and Cascade Head and just north of the Columbia River (fig. 1).

The primary aim of the explorations was to locate and delineate concentrations of scallops along the Oregon coast. Secondary aims were to (1) obtain information on the catch rates of the 8-foot, New Bedford-type, scallop dredge--and to compare its catching efficiency with that of a modified 400-mesh eastern otter trawl; (2) collect biological data on size, distribution, and abundance of scallops; and (3) collect scallops for meat-yield analysis by the Oregon State University Seafoods Laboratory at Astoria.

THE SCALLOP RESOURCE

Scallops are an important fishery resource along the Atlantic coast of the U. S. (Posgay, 1957) and Canada (Bourne, 1964). A moderate scallop fishery existed in Puget Sound, Wash., between 1935 and 1952. No sustained scallop fishery exists today along the Pacific coast of the U. S. and Canada, although recent

catches off Kodiak, Alaska, indicate a fishery may develop there in the near future. Because there has been considerable speculation on the availability of scallops, surveys

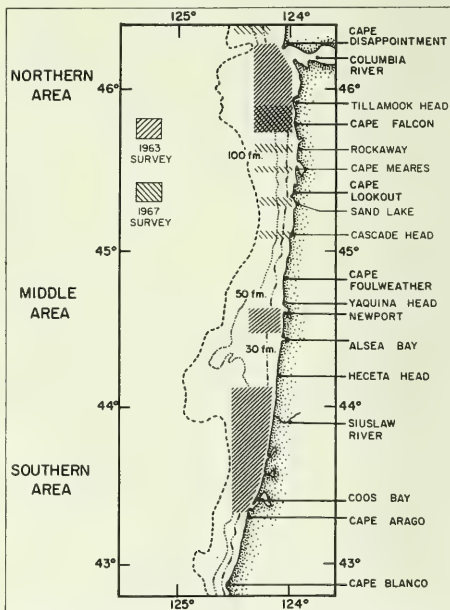


Fig. 1 - The areas surveyed for scallops off Oregon coast.

*Fishery Biologists, BCF Exploratory Fishing and Gear Research Base, Seattle, Wash. (Mr. Ronholt now with BCF Exploratory Fishing and Gear Research Base, Juneau, Alaska.)

have been made in Alaska (Rathjen and Rivers, 1964) and along the Pacific coast of Canada (Quayle, 1961 and 1963).^{1/}

The presence of scallops off the Oregon and Washington coasts has been known for many years. Commercial fishermen report numerous scallops taken frequently by otter trawls and halibut longline gear. The quantity usually is not large enough to market, but at times enough are caught to be used as food aboard fishing vessels.

Interviews with otter trawl fishermen, industry representatives, and personnel of Washington and Oregon fishery agencies indicated that few attempts had been made to harvest this resource commercially. Several years ago, a small vessel fished commercially out of Tillamook Bay, Oregon, using an otter trawl modified to dig into the bottom. Several fishermen have reported sporadic catches up to 500 pounds per drag. These interviews indicated that scallops were generally located along the entire Oregon and Washington coast at 40 to 60 fathoms and that a potential resource might exist.

GEAR AND METHODS

An 8-foot, New Bedford-type, scallop dredge was the primary gear used in the survey. The frame and bail of the dredge were made of steel, the bag of manila rope and welded steel rings connected by dredge links, and the club of oak and steel (fig. 2). Rathjen and Rivers (1964) used a similar dredge in the 1963 Gulf of Alaska explorations. Posgay (1957) and Bourne (1964) give detailed descriptions of this type of dredge and the method of operation.

A commercial 400-mesh eastern otter trawl (Greenwood, 1958), modified by the addition of 60 feet of $\frac{5}{8}$ -inch chain to the foot-rope to keep it near the bottom, was also used during the 1963 survey.

Prior to the explorations, information on the geographic and bathymetric distribution of scallops and the possible locations of commercial concentrations was obtained by interviews. This information was then used in establishing the sampling design.

The sampling procedure followed a predetermined grid pattern in which $\frac{1}{2}$ -hour drags

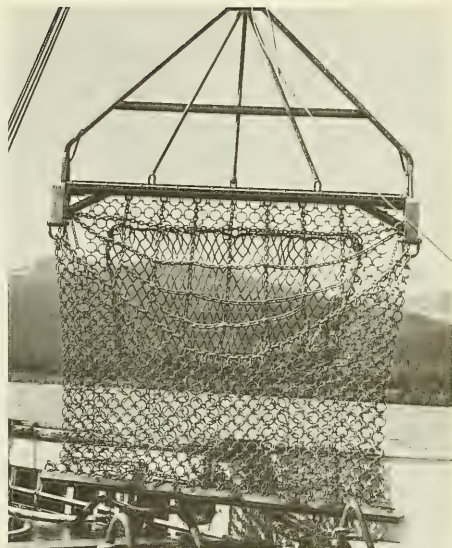


Fig. 2 - An 8-foot, New Bedford-type, scallop dredge (photo courtesy of Exploratory Fishing and Gear Research Base, Juneau, Alaska).

were made parallel to the coast at 5-fathom increments from 30 to 70 fathoms at 5 to 10 nautical mile intervals. Between each series of parallel stations, a drag (generally 1-hour long) was usually made perpendicular to the coast from about 30 to 60 fathoms to reduce the likelihood of missing significant concentrations. The interval between stations was reduced to 2.5 nautical miles when availability was greater than 1 bushel per one-half hour, or when fishing an area where a concentration of scallops had been reported.

The data collected included: (1) pounds and numbers of scallops taken, (2) height frequency of catches, and (3) total pounds of the associated catch. Scallops were counted and placed into a bushel basket that was then weighed on a spring scale. Scallop height (the distance from posterior margin of hinge to leading edge of shell in a line perpendicular to hinge) was measured with vernier calipers.

RESULTS OF 1963 SURVEY

Two otter trawl hauls and 124 scallop dredge hauls were made during this survey in three distinct areas (fig. 1). To facilitate

^{1/}Unpublished reports, Fisheries Research Board of Canada, Biological Station, Nanaimo, B.C.

analysis, these areas are called: the Southern area, Cape Arago to Heceta Head; the Middle area, Alsea Bay to Yaquina Head; and the Northern area, Cape Falcon to the Columbia River. The results of the hauls can best be presented in the following three divisions: (1) availability of scallops and associated fauna to the scallop dredge, (2) size and meat yields of scallops, and (3) relative catching efficiency tests.

Availability to Dredge

Of the 124 scallop dredge hauls, 72 were made in the Southern area; 8 in the Middle area; and 44 in the Northern area. With the exception of three hauls on the Siuslaw River bed, all dredge hauls in the Southern and Middle areas were made at a scope ratio (length of towing cable to water depth) of 4 to 1. Speed over the bottom ranged from 1.4 to 4.0 knots and averaged 2.9. All hauls in the Northern area, and three on the Siuslaw River bed, were made at a scope ratio of 3 to 1. The speed over the bottom ranged from 1.8 to 4.6 knots and averaged 3.5.

Southern Area

Of the 72 hauls (fig. 3) between 30 and 60 fathoms, 39 took scallops. The largest catch rates occurred along the 40- and 55-fathom depth contours, where the average catch was 14 and 57 scallops per one-half hour, respectively (table 1). The average catch along the 55-fathom contour for the entire area is probably overestimated because 10 of the 16 hauls were replicate hauls made off the Siuslaw River. There, the greatest availability occurred on a well-defined bed (fig. 3). Most scallops were taken on this bed--up to 175 per $\frac{1}{2}$ -hour haul.

Table 1 - Number of $\frac{1}{2}$ -Hour Hauls and Average Catch Rates of Fish and Shellfish Taken in Southern Area

Midpoint of Depth Intervals	$\frac{1}{2}$ -Hour Hauls	Average Per $\frac{1}{2}$ -Hour Haul				
		Scallops	Crab	Starfish	Sea Pens	Fish
Fathoms	No. $\frac{1}{2}$	(Number) (Pounds)				
30	7	0.1	25.1	6.4	-	2.0
35	7	2.2	38.8	3.0	-	2.7
40	11	13.7	9.3	3.9	-	5.2
45	7	9.8	2.3	3.4	-	1.6
50	9	6.8	0.5	0.2	-	0.1
$\frac{2}{55}$	16	56.7	2.2	1.1	0.7	0.9
60	9	9.0	0.1	0.4	8.4	1.6

¹Six perpendicular hauls, Nos. 9, 17, 25, 33, 41, and 42 (fig. 3), made across the depth contours were excluded from this table.

²Data for this interval include 10 replicate dredge hauls made off Siuslaw River on highly productive beds.

In the 72 hauls, 1,325 pounds of fish and shellfish were captured. Of this weight, scallops were 37 percent, Dungeness crab (*Cancer magister*) 25 percent, fish 12 percent, starfish 13 percent, sea pens 7 percent, egg cases of big skate (*Raja binoculata*) 5 percent, and miscellaneous invertebrates 1 percent. Dungeness crabs were found primarily in the shallower depths (30 and 35 fathoms, table 1) from Coos Bay to Siuslaw River. Starfish and fish catches were common but small at all depth intervals. The sea pens occurred only in the deep-water intervals. Skate egg cases were found primarily in three hauls, Nos. 49, 50, and 51, made just off the Siuslaw River mouth--and the numbers taken were 61, 19, and 38, respectively.

Middle Area

The catches of eight hauls consisted primarily of starfish and miscellaneous fish in amounts of less than 25 pounds per $\frac{1}{2}$ -hour haul. No scallops or crabs were taken.

Northern Area

Scallops were found in 34 of the 44 hauls and were distributed primarily between 40 and 65 fathoms (fig. 4). Catches were larger here than in the other two areas surveyed. The catch rates were best at the 50- and 55-fathom depth contours, where they averaged 289 and 316 scallops per $\frac{1}{2}$ -hour haul (table 2). The largest catches occurred in three hauls between Tillamook Head and Cape Falcon near the 50-fathom depth contour. The haul numbers were 107, 112, and 116, and their respective catches were 635, 619, and 753 scallops per $\frac{1}{2}$ -hour haul.

Table 2 - Number of $\frac{1}{2}$ -Hour Hauls and Average Catch Rates of Fish and Shellfish Taken in Northern Area

Midpoint of Depth Intervals	$\frac{1}{2}$ -Hour Hauls	Average Per $\frac{1}{2}$ -Hour Haul				
		Scallops	Crabs	Starfish	Sea Pens	Fish
Fathoms	(Number) (Pounds)					
30	1	-	44.0	3.0	-	-
35	6	0.2	16.7	6.5	-	1.6
40	7	16.4	24.1	2.1	-	0.6
45	8	98.1	124.5	2.6	-	0.4
50	8	289.0	14.6	3.6	-	0.6
55	7	316.3	0.6	8.0	-	2.6
60	5	38.6	0.2	3.4	1.2	0.8
65	2	5.5	-	-	1.0	1.0

In the 44 hauls, 3,692 pounds of fish and shellfish was taken. Of this weight, scallops made up 50 percent; Dungeness crab, 41 percent; fish, 1 percent; starfish, 6 percent; and egg cases of big skate, 2 percent. Dungeness

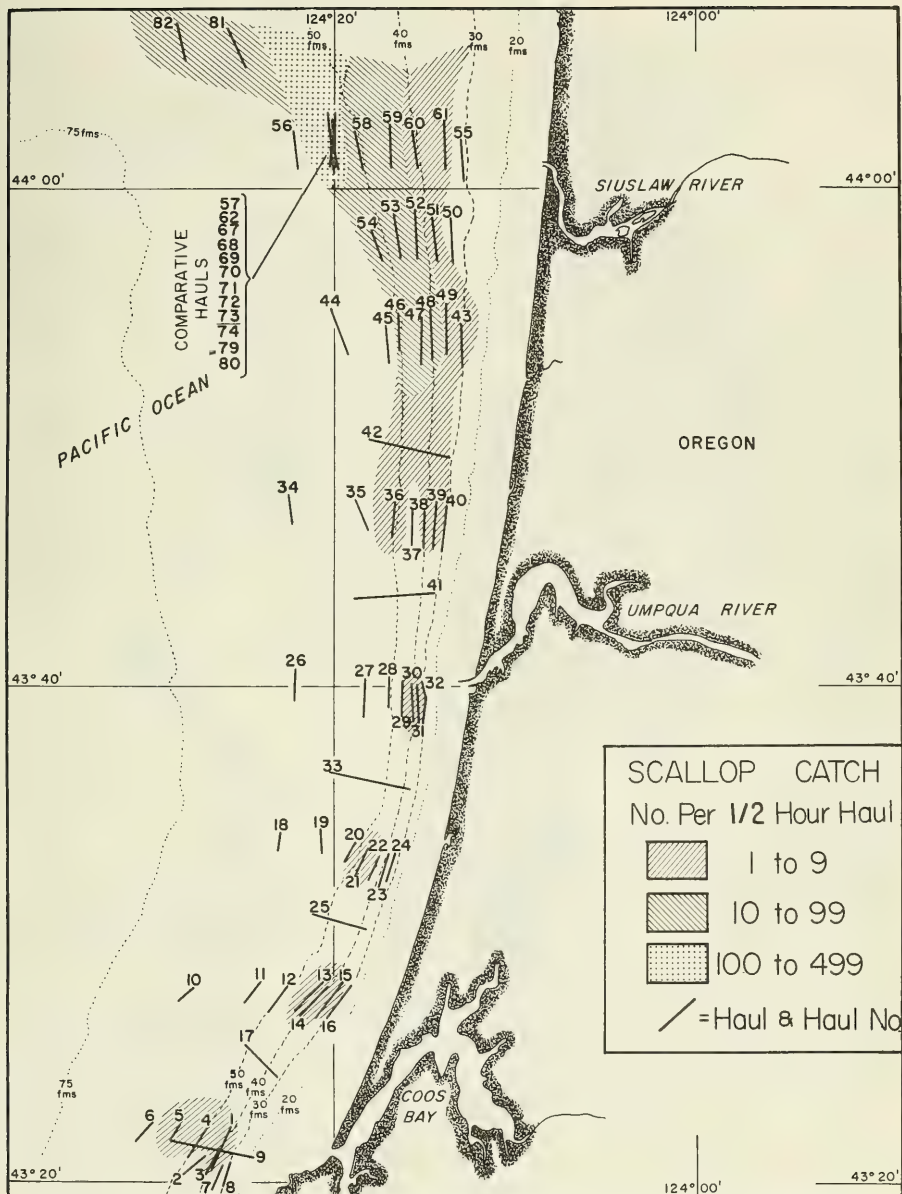


Fig. 3 - Distribution and relative abundance of scallop and location of scallop dredge stations in Southern area.

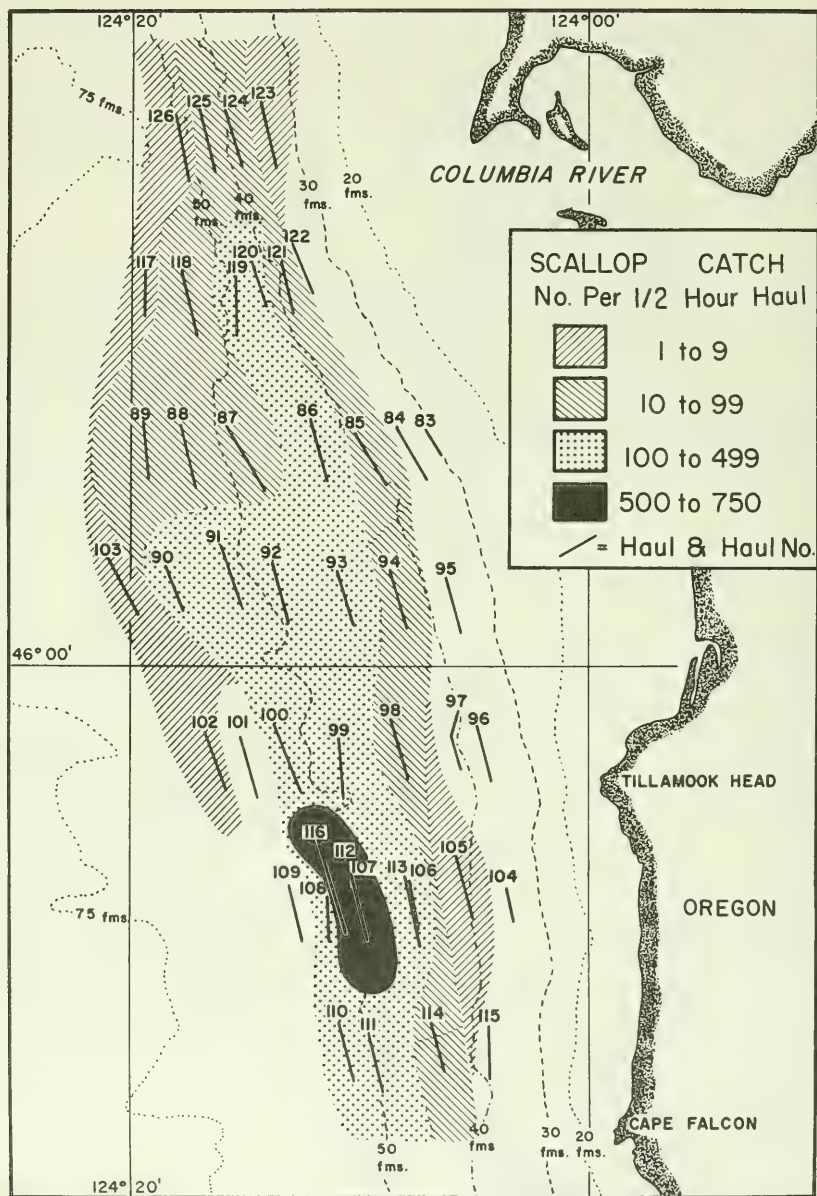


Fig. 4 - Distribution and relative abundance of scallop and location of scallop dredge stations in Northern area.

crabs were found primarily in the shallow depth intervals (table 2) off the Columbia River. Fish and starfish catches were relatively small and occurred at all depths. Trace amounts of sea pens were taken in some deep hauls. Skate egg cases were dominant in one haul (No. 96) off Tillamook Head; there, 150 cases were taken.

Size and Meat Yields

A bushel basket contained an average 117 scallops weighing an average 45 pounds in the Southern area--and 150 scallops weighing 50 pounds in the Northern area. Southern area scallops were taller in height than Northern area scallops (fig. 5). In the Southern area, they ranged from 3.3 to 6.3 inches and averaged 4.6 inches; in the Northern area, they ranged from 3.1 to 5.1 inches and averaged 4.2 inches. In both areas, the largest scallops were taken in the shallower depth intervals, and the average size decreased with increasing depth. This trend is clearly shown when the height-frequency data are plotted by 5-fathom depth intervals for each area (fig. 6).

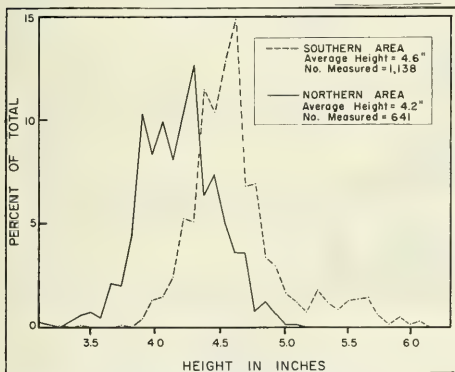


Fig. 5 - Comparison of height frequency of scallops taken in Northern and Southern areas of the Oregon coast.

We delivered 798 pounds of scallops to the Oregon State University Seafoods Laboratory in Astoria for a meat-yield analysis. The results are available in a mimeographed report by Law^{2/}. Of total weight, the adductor muscles, or meats, made up 7 percent; the shell, 57 percent; the remaining body, 33 percent; and water loss, 3 percent. The size of meats

ranged from 28 to 34 count per pound (average 31.3) in the samples from the Southern area, and from 51 to 58 count per pound (average 53.5) from the Northern area. By soaking the meats in fresh water for about 12 hours, their total weight increased 14 percent.

Relative Catching Efficiency Tests

A series of 12 comparative tows was made on the Siuslaw River bed in 55 fathoms in the Southern area to determine: (1) if changes in scope ratio affected the catching efficiency of the 8-foot, New Bedford-type, dredge for weathervane scallops; and (2) if a modified 400-mesh Eastern otter trawl was more efficient at catching scallops than the New Bedford-type dredge. Ten hauls were made with the dredge, three (Nos. 69, 70, and 71) at a scope ratio of 3 to 1 and seven (Nos. 57, 62, 67, 68, 72, 73, and 74) at a scope ratio of 4 to 1. Two hauls (Nos. 79 and 80) were made with the otter trawl at a scope ratio of 3 to 1 (table 3). The average speed over the bottom during all hauls was about 3 knots.

Table 3 - Catches Taken in Comparative Hauls Made on Siuslaw River Scallop Bed

Item	8-Foot Scallop Dredge		Otter Trawl
	Scope Ratio, 4:1	Scope Ratio, 3:1	Scope Ratio, 3:1
Number of hauls	7	3	2
Average speed over the bottom (knots)	2.8	2.9	3.0
Average catch of all species (pounds)	21	36	397
Average occurrence of scallops in catch (%)	91	89	5
Number of scallops per 1/2-hour haul:			
Average	60	163	33
Range	5-135	145-175	23-43

Despite the small number of hauls, certain relations are apparent. The average number of scallops in the dredge catches was about twice as large when the dredge was fished at a scope ratio of 3 to 1 than when fished at 4 to 1; this indicates that 3 to 1 was a better scope ratio when fishing this gear between 30 and 60 fathoms. The dredge was more efficient at taking scallops than the modified 400-mesh Eastern otter trawl--but it was very inefficient in taking fish species, which made up the major part of the trawl catches. Scallop catch by weight made up 91 and 89 percent of the dredge catches, but only 5 percent of trawl catches.

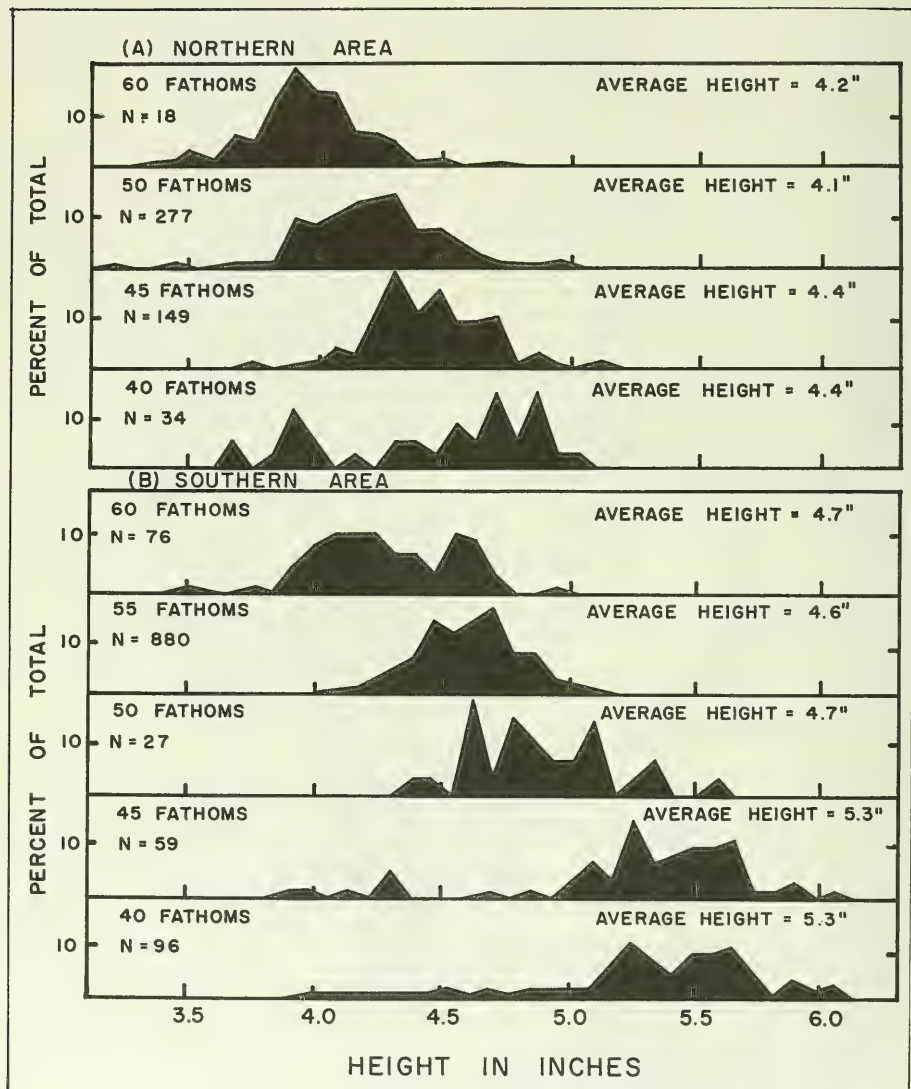


Fig. 6 - Comparison of height frequency by depth for scallops taken in (A) Northern area and (B) Southern area.

RESULTS OF 1967 SURVEY

During the 1967 survey, 48 scallop dredge hauls were made. Between Tillamook Head and Cape Falcon, Oregon, 13 hauls were made at 1963 survey stations (fig. 1). Of the remaining hauls, 7 were off Rockaway, 6 off Cape Meares, 6 off Sand Lake, 4 off Cascade Head, and 10 just north of Columbia River. All hauls were $\frac{1}{2}$ -hour long. They were made at a scope ratio of 3 to 1, and speed over bottom ranged from 2.2 to 5.4 knots and averaged 3.9 knots.

Of the total hauls, 24 contained scallops. The largest catches occurred along the 55- and 60-fathom contour (table 4). The largest catch, 118 scallops, was taken off Sand Lake in 55 fathoms.

Table 4 - Number of $\frac{1}{2}$ -Hour Hauls and Average Catch Rates of Fish and Shellfish Taken in 1967 Survey

Midpoint of Depth Intervals	$\frac{1}{2}$ -Hour Hauls	Average Per $\frac{1}{2}$ -Hour Haul				
		Scallops	Crabs	Starfish	Sea Pens	Fish
Fathoms		(Number)				(Pounds)
25	2	-	2.0	4.0	-	5.0
30	1	-	6.0	79.0	-	1.6
35	7	-	68.7	15.6	-	4.2
40	7	1.6	10.0	14.0	-	2.9
45	7	3.1	11.1	28.1	-	2.4
50	7	6.3	2.4	11.3	.1	1.8
55	8	17.3	14.4	42.8	.1	2.8
60	7	10.4	4.4	11.4	.5	2.5
65	2	1.5	2.0	12.5	.3	2.1

In the 48 hauls, 982 pounds of fish and shellfish were taken. Of this weight, scallops were 7 percent, Dungeness crab 44 percent, fish 13 percent, starfish 17 percent, egg cases of the big skate 16 percent, and miscellaneous invertebrates 3 percent. Skate egg cases were abundant on the same bed in 1967 and 1963 (Haul 96, fig. 4).

The 1967 catches (table 4) were similar to 1963's (tables 1 and 2) except for amount of

scallops and starfish taken. The fish were found in all depth intervals, whereas sea pens were found only in deeper waters. Most crabs were found in greatest abundance in the shallower depths of less than 50 fathoms. The starfish were found at all depth intervals in both years; a higher catch rate occurred in 1967 samples. On the other hand, the scallops were found primarily between 40 and 65 fathoms; the greatest abundance occurred in about 55 fathoms.

Table 5 - Number of Scallops and Empty Scallop Half Shells Taken in Duplicated Hauls Between Tillamook Head and Cape Falcon

1963 Haul	Depth of Bottom	Number Per $\frac{1}{2}$ -Hour Haul			
		Live Scallops		Scallop Half Shells	
		1963	1967	1963	1967
Number	Fathoms				
104	35	0	0	0	0
105	40	3	10	0	0
1/113	45	122	0	30	22
107	50	635	0	40	38
112	50	619	2/	50	2/
116	53	753	0	33	142
108	55	312	0	30	36
109	60	0	0	0	44
115	40	0	0	0	0
114	45	12	7	0	6
111	50	292	3	50	76
110	55	426	0	50	76

1/Haul 113 was a repeat of haul 106, which was unsuccessful because dredge fished upsidedown.
2/In 1963, two hauls, 107 and 112, were made at same place, but only one haul was made here in 1967.

In 1963, the catch rate of scallops was high in the drags between Tillamook Head and Cape Falcon, especially in haul Nos. 107, 112, and 116 (fig. 4). All these hauls were duplicated in 1967, and the best catch was only 10 scallops (table 5). The dredge apparently was fishing in the same manner as in 1963 because empty scallop shells were taken in about the same quantity. The one exception was haul No. 116, where there was an increase of over 100 half shells.

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INTERNATIONAL

Some Major Fishing Industries Are in Trouble

The tide is turning for several of the world's major fishing nations--including Norway, the United Kingdom, Iceland, and Canada, where fishing is both important to the economy and an honored tradition. Their fisheries expanded appreciably during the past few years. Today, these nations are dusting off subsidy programs to buoy their industries.

Here is an outline of the situation:

- **NORWAY**, Europe's leading fishing nation and 5th in the world, was hit hard in 1967: prices fell drastically; the stockfish market was virtually lost, so too was the fresh-fish market in the United Kingdom; the boatbuilding boom ended; she suffered losses from currency devaluation by her major customers. And 1968 began with the awful collapse of the winter herring fishery.

Norway was forced to give US\$850,000 to cover losses from devaluation. She is extending an interest-free US\$4 million loan to cover inventories of stockfish exporters. She has offered to provide 7,000 tons of stockfish to the UN's Food and Agriculture Organization for the World Food Program. She probably will increase exvessel prices by larger subsidies.

- **UNITED KINGDOM** is completely reversing its fishery policy. This had been in line with recommendations of the Organization for Economic Cooperation and Development designed to end operating subsidies. Now the UK is increasing aid to parts of the industry. Government and industry leaders are discussing a minimum price scheme. Market sharing with the European Free Trade Association (EFTA) is being investigated.

- **ICELAND's** industry suffers from inefficiency and over capacity. Landings have fallen. She has lost a valuable stockfish market. The Government is providing US\$5.1 in new subsidy funds to aid the industry.

- **CANADA** is adopting floor price supports for several Atlantic coast species. The

support would guarantee a minimum price to fishermen in 1968 for cod, ocean perch, or flounder.

- **GREENLAND's** industry is enveloped by a net of adversity.

- **SWEDEN's** fishermen have seen their earnings fall 30 percent in 2 years.

- **FRANCE**, hit by fishermen's strikes, has moved to establish minimum import prices for several fish species.

- **WEST GERMANY's** fishing industry is suffering from financial deterioration. The coastal provinces have asked for Government help.



Increase in 1968 Yellowfin Tuna Quota Adopted

Member countries of the Inter-American Tropical Tuna Commission (IATTC) voted unanimously to increase the 1968 catch quota for yellowfin tuna in the eastern tropical Pacific Ocean by 13,000 short tons. The new quota is 106,000 short tons. The increase was based on catch data and observations of fishermen and scientists indicating a yellowfin tuna abundance higher than previously indicated.

Vote by Mail

The vote to increase the quota was taken by correspondence among IATTC member governments--Canada, Costa Rica, Ecuador, Mexico, Panama, and the U. S. Concurrence was announced May 21 by IATTC's Director of Investigations.

Fishery Is Closed

The fishery was closed on June 18. After that date, U.S. tuna seiners would be allowed an incidental take of yellowfin up to 14 percent. Bait boats could take an incidental catch of 40 percent until they reached 1,500 tons.



50 Asian Vessels Fish for Atlantic Tuna

About 20 Japanese and 30 Formosan and South Korean tuna long-liners were fishing for albacore tuna in the eastern Atlantic Ocean off Angola in early May. Fishing was reported good. The vessels were catching around 3 metric tons and as much as 5 tons per set. However, because the albacore were small (29-31 pounds), the export price dropped sharply to around \$445 a short ton c.i.f. Puerto Rico. Large albacore taken in the Atlantic were bringing around \$475 a short ton c.i.f. Puerto Rico.

Summer Season

As the summer season approaches, albacore fishing begins to pick up in the more northerly regions of the Atlantic, off the Azores and Bermuda Islands, and in the West Indies off Saint Martin Island. Good fishing in those regions could further depress the albacore export price.

In Gulf of Guinea

Yellowfin fishing in the Gulf of Guinea, where good catches had been made, was reported declining in early May. The fishery in the central equatorial Atlantic also was tapering off. ("Suisan Tsushin," May 8, 1968.)



WHAT IS THE SOURCE OF THE GULF STREAM?

The Gulf Stream received its name because of the misconception that its source was the Gulf of Mexico. It is now known that water of the Gulf contributes very little to the flow of the Gulf Stream.

Two currents, the North and the South Equatorial Currents, join to flow through the passages between the Windward Islands into the Caribbean Sea. The resultant current, flowing through the Yucatan Channel, has only one outlet between Florida and Cuba. Off the southern coast of Florida, other currents coming from the northern coast of Puerto Rico and eastward from the Bahamas add to the flow of the Gulf Stream. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

Sweden Aids India's Fisheries

The Swedish International Development Authority (SIDA) will present 2 trawlers to India as gifts late this summer after shake-down and crew training. The 2--"Blue Fin" and "Red Snapper"--were launched at Solvesborg in southern Sweden on April 25, 1968.

Both trawlers are the Norwegian Norske Veritas class: 93 feet long, crew of 13, accommodations for 16 students, and equipped with a small laboratory.

Vessels Under Aid Agreement

The vessels, training program, and cost of cruise to India are all included in the gift. It will be made under the 1965 Swedish-Indian aid agreement. Total cost: US\$700,000, including cost of building and US\$563,000 cost of equipping. FAO provided technical advice in selecting suitable vessels.

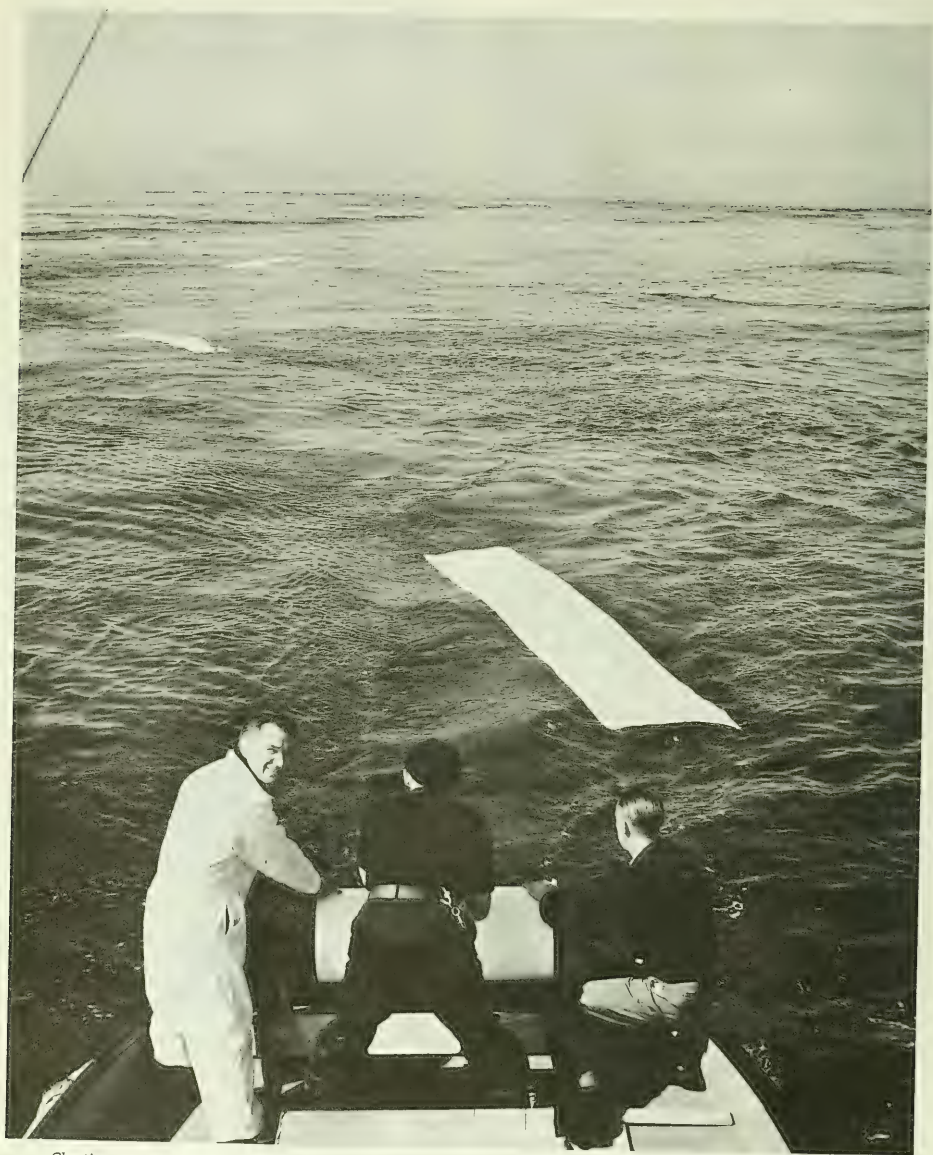
Vessels for Fishermen Training

Once the trawlers have arrived in India, their uses will be determined by the Indian Government. It is expected that their main function will be to train fishermen in efficient fishing methods. Also, they will be capable of supporting research in processing and preserving fish, and in marine biology and associated sciences.

The Indian crews of four per ship--1 captain, 1 engineer, and 2 master fishermen--were scheduled to arrive in Sweden around June 1. Following training, they will sail for India at the end of August with the Swedish training crews.

After arriving in India, sometime in November, both ships will be used initially in the Bay of Bengal. At least one will operate from Madras. The Ministry of Food and Agriculture will direct their operation. (U. S. Embassy, Stockholm, May 10, 1968.)





Charting ocean currents off British Columbia with strips of paper for pollution study. (Dept. of Fisheries, Canada.)

FOREIGN

CANADA

FISHERIES COUNCIL ADOPTS RESOLUTIONS

The Fisheries Council of Canada, an important national industry group, held its 23rd Annual Meeting in Vancouver, May 5-8. It elected Richard I. Nelson of Vancouver president, and adopted these resolutions:

(1) Canada either should declare immediately the straight baseline as described in the Council's brief to the Government in January 1963--enclosing her territorial sea and from which her 12-mile exclusive fishing zone would be measured--or Canada should declare immediately exclusive fishing zones only in those areas.

(2) Canada should seek early convening of a Law of the Sea Conference. The Conference could resolve matters of fishing rights and jurisdiction not met by declaration of exclusive fishing zones--particularly, international acceptance of the abstention principle for anadromous fish, and the status of marine resources over the Continental Shelf.

(3) The Federal and Provincial Governments should set up machinery to combat possible pollution from marine disasters.

(4) The Federal Government, through tax incentives, should encourage installation of pollution-control facilities in industry. In those jurisdictions where a machinery tax is levied, pollution-control facilities should be exempt.

(5) Legislation should be enacted to enforce existing legislation. It should ensure that: (a) Fisheries interests are safeguarded in all proposals to discharge industrial and domestic wastes; (b) adequate budget and facilities are made available to the Fisheries Research Board to start long-range studies to determine effect of industrial and domestic pollution on river estuaries and salt-water bodies critically important to fishing industry; (c) the Federal Department of Fisheries and appropriate Provincial Pollution Control authorities establish workable means of monitoring major industrial and domestic effluents at outfall, and create deterrent penalties

to ensure that acceptable levels of outfall are maintained; and (d) the Federal Department of Fisheries should become more actively involved in formulation of a national water policy. ("Fisheries Council of Canada Bulletin," May 1968.)

* * *

OPENS WORLD'S LARGEST SALMON-REARING STATION

The world's largest Atlantic salmon rearing station has begun to operate fully on the St. John River in New Brunswick. It is near the site of the Mactaquac power dam, a few miles upstream from Fredericton. The station can produce a half-million juvenile salmon to perpetuate salmon runs on the historic river that would be blocked by the 600,000-kilowatt hydroelectric plant.

Canada's Department of Fisheries cooperated with the New Brunswick Power Commission to sponsor the multi-million-dollar hatchery as the solution to the dam-created problem.

Salmon-Rearing Station

The 13-acre station at Mactaquac actually started to function last fall. Already, the first of future generations of salmon have been released to the rearing ponds. The 300,000 tiny salmon that emerged from the egg stage in February 1968 will be raised to the smolt or sea stage. Then they will be able to leave, in their own time, on the down-stream run to the sea.

Adult Salmon Selected

Adult salmon are trapped at the dam site. There, about 1,000 of the estimated 10,000 to 20,000 adult fish, which normally would migrate past Mactaquac, are selected for breeding purposes at the station. The remaining fish are transported in specially designed New Brunswick (N. B.) Power Commission trucks above the 60-mile-long headpond to meet needs of anglers in the upper reaches of the over 400-mile-long river and its tributaries.

This transport operation will leave 2 angling sites relatively unimpaired. They are

Canada (Contd.):

on the main river between Hartland and the Beechwood dam, and on the Tobique River beyond the dam headpond.

Salmon's Obstacle Course

If the salmon released in the Hartland-Mactaquac stretch of water successfully run the gauntlet of anglers, they can ascend the Beechwood lift. This is an electrically operated elevator-like apparatus that carries the fish over the dam. The salmon then can make their way up the Tobique dam fishway and enter the angling fishery in the waters beyond. The survivors will eventually spawn there. One reason for the special rearing facilities is that the downstream mortality of smolts imposed by 3 sets of turbines and the large Mactaquac reservoir will be heavy.

Brood Stock Collection

The brood-stock-collection phase of the Mactaquac breeding program began in June 1967 and continued through the fall salmon run in October. The best salmon and grilse (a 3-6-pound salmon with a 1-year sea life) as determined by general health, lengths and weights, were selected from each day's catch for the brood stock. Excess fish were transferred upstream to assure fish for anglers, and a natural spawning stock for the St. John River system.

Strongest "Races" Sought

Federal fisheries biologists are aiming at a scientifically controlled selective breeding program to produce the strongest possible "races" of salmon for the St. John River. It will take 3 or 4 years before it will be possible to evaluate the results of the breeding. Then, the program will become progressively more selective in order to use the age groups that yield the best results. (Canadian Dept. of Fisheries, May 22, 1968.)

* * *

REDUCTION HERRING FISHERY
CLOSURE CONTINUES

No reduction herring fishing will be allowed for the 1968/69 season on Canada's west coast, the Government announced on May 3, 1968. Although spawning reports showed improvement over those of 1967/68, the worst on record, they did not justify relaxation of total closure imposed then.

Canada's Department of Fisheries is conducting research programs to aid the fishery. Also, it is trying to examine the possible use of herring for food, particularly because of its high protein yield. ("The Fisherman," May 10, 1968.)

* * *

FISHERMEN WILL GET
EMERGENCY FINANCIAL HELP

Canada is studying conditions in the Atlantic Coast groundfish industry resulting from a depressed market for frozen fish products. The government wants to promote orderly marketing and prevent serious losses to fishermen and processors. It is prepared to give emergency financial assistance to Atlantic Coast fishermen dependent on the groundfish fishery if the 1968 season seriously depresses fishermen's incomes.

The government's deficiency payment plan will be computed on the average price per pound of catches of cod, ocean perch, and flounder received over the last 3 years.

Government Helps

The Department of Fisheries is accelerating its programs to improve the industry. It has commissioned an in-plant efficiency study to reduce processing costs. This study will be extended to production methods and trawler efficiency.

The Federal Government is cooperating with the Provinces and the Fisheries Council of Canada in sponsoring an industry study of the Canadian market for fishery products.

New export promotion schemes are being developed to supplement the already-extensive export sales programs of the Department of Trade and Commerce. Also, the Atlantic Development Board has begun an in-depth study of marketing methods of the Atlantic Coast industry in the U. S. market.

These plans are intended to make the industry capable of holding its own in the world markets.

Uncertain Market

Returns to fishermen for the balance of the 1968 season depend on the market situation. The market's future cannot now be determined, nor can the amount of government aid. (Canadian Dept. of Fisheries, May 23.)

* * *

Canada (Contd.):

1966-67 FISH MEAL PRODUCTION
AND TRADE

Production		
	1967	1966
	. . . (1,000 Lbs.) . . .	
Atlantic Coast:		
Groundfish	76,312	83,188
Herring	97,686	51,762
Other	3,100	3,006
Total	177,098	137,956
British Columbia:		
Herring	19,356	54,362
Total meal	196,454	192,318

Source: "Monthly Review of Canadian Fisheries Statistics."

Imports		
	1967	1966
	. . . (1,000 Lbs.) . . .	
From:		
Peru	2,085	-
United States	80	12,000
Total	2,165	12,000

Source: "Trade of Canada."

Exports		
	1967	1966
	. . . (1,000 Lbs.) . . .	
Country of Destination:		
(A) Herring Meal & Pilchard Meal:		
United Kingdom	5,338	1,539
Belgium-Luxembourg	-	400
United States	69,354	71,429
Total	74,692	73,368
(B) Other Fish Meal:		
United Kingdom	16,176	24,166
Leeward & Windward Islands	42	50
Trinidad-Tobago	123	30
Guyana	42	-
United States	13,216	8,282
Total	29,599	32,528

Source: "Trade of Canada."

* * *

VESSEL INSURANCE INCREASED

Effective June 15, insurance protection provided to commercial fishing vessels under the federally sponsored Fishermen's Indemnity Plan was extended to cover craft with a maximum appraised value of C\$25,000. This supersedes the existing insurable maximum limit of C\$15,000. The minimum appraised value acceptable remains C\$250.

Higher Costs

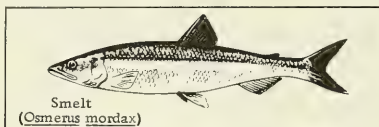
The extension results from higher construction costs, and the trend among fishermen to obtain larger craft capable of diversified fishing.

The Fishermen's Indemnity Plan agency has insured nearly 8,000 vessels in Canada with a total appraised value of C\$35 million. Over C\$19 million of this is in British Columbia. (Canadian Dept. of Fisheries, June 12.)

* * *

SMELT IS VALUABLE RESOURCE

Smelt is a valuable resource harvested commercially all year.



More than twelve and one-half million pounds of the little silver fish were taken by Ontario fishermen during 1967, principally in trawling operations. The catch was worth well over one-half million dollars to them. The economy of Ontario benefits by at least double this amount when the value of processing and related services is included.

Much Sold to U. S.

Much of the product is sold in the United States, but Ontario retail frozen-food cabinets also are well stocked with this reasonably priced gourmet food.

Scientists have formulated effective methods of fishery management. So it is expected that this rich harvest will continue to be available for years to come--with plenty to go around for sports and commercial fishermen.



EUROPE

USSR

TRENDS IN SOVIET FISHERIES

The Soviet Ministry of Fisheries was criticized during a recent full meeting of the Central Committee of the Union of Food-Processing Workers of the USSR. Problems concerning organization of labor and increased productivity of several food-processing industries were discussed.

Speakers noted that 20 percent of all fishery enterprises failed to fulfil the 1967 labor productivity plan. The introduction of modern and mechanized equipment into the fishing industry is slow.

Most fish cleaning aboard vessels is still manual.

Scientists Are Ignored

N. Vaniaev, Fisheries Minister of the Russian Soviet Socialist Republic, said that the achievements of fishery scientists and engineers are being ignored. While East Germany's fleet is already using electric trawls designed years ago by a Soviet scientist, the gear will not be installed aboard Soviet fishing vessels until 1969.

Union speakers affirmed that the Soviet Ministry of Fisheries is generally indifferent to suggestions from innovators. On Jan. 1, 1968, over 7,000 suggestions were lying around untouched.

Construction Ministry Criticized

The Soviet Ministry of Construction also was criticized severely. The 5-Year Plan provides for construction of 1,500 food-processing plants and buildings by 1970, but actual construction lags. Only 63 percent of planned construction projects for the Ministry of Fisheries was actually built.

Other Soviet ministries fared poorly too; only 41 percent of planned construction was done for the Ministry of Power and Electrification, and 65 percent for the Agriculture Ministry.

Some Encouraging Reports

The Central Committee noted a few encouraging signs. New, well-equipped, enterprises raised labor productivity in the fishing industry by 8.6 percent during 1966-67. The ranks of "shockworkers of Communist labor" are constantly growing. Now this title is held by every 8th worker in the fishing industry. The title of "Communist crews" was awarded to 870 crews of fishing vessels. ("Ekonomicheskaja Gazeta," No. 19, May 1968.)

* * *

FAR EASTERN FISHERY TELECOMMUNICATIONS DISCUSSED

A meeting on communications, radio navigation, and exploratory research techniques was held in October 1967 at the Fisheries Administration in Vladivostok. It was attended by inspectors of the Far Eastern fishing fleets and by representatives of the Western and the Azov-Black Sea Fisheries Administrations.

The Complaints

Many speakers criticized the poor use made of up-to-date telecommunications and radio navigation equipment, especially in exploration and research. They said: (1) many radio specialists at the Far Eastern Fisheries Administration lack the necessary theoretical background, (2) not enough radio specialists are graduating from the region's nautical schools, (3) most radio centers are unable to handle constantly increasing traffic, and (4) no refresher or advanced courses for radio specialists are available.

Reasons for Shortcomings

A resolution adopted pinpoints the causes of these shortcomings as lack of an independent agency to study fishery telecommunications problems--and an insufficient number of qualified specialists. ("Rybnoe Khozjais-tvo," No. 2, 1968.)

* * *

USSR (Contd.):

STEPS UP FISHERY RESEARCH IN POLAR REGIONS

The Polar Scientific Research Institute of Fisheries and Oceanography (PINRO) has stepped up research by its Northern Division, especially in the White and Barents Seas.

Polar Regions Research

Soviet scientists will study populations of salmon, whitefish, navaga (*Eleginus navaga*), and herring; stocks of marine mammals in the White and Barents Seas; availability of algae for commercial purposes. Other projects will try to improve Soviet coastal-fishing techniques and perfect the technology of processing fish, algae, and marine mammals.

Marine Algae

The laboratory of marine algae, headed by K. Gemn, is studying algae in the gulfs and inlets of the White Sea. Tidal electric power stations will be built there. The laboratory has studied the artificial cultivation of the alga *Chlorella* in the White Sea, where the natural stock of this alga is depleted. Algae are of primary importance in producing agar-agar. The latter is manufactured in the USSR by only 4 plants. The plants do not meet the needs of the Soviet economy.

The laboratory of marine mammals, under A. Golechenko, is studying seal-skin processing to improve the quality of furs.

A group of scientists headed by T. Gosheva has observed systematically herring shoals in the Gulfs of Onega and Dvina. The group established new regulations for herring fishing.

Salmon and Whitefish

Ichthyologists of PINRO's Northern Division, supervised by M. Morshtin, have investigated the population trends of Pechora salmon and whitefish. Maximum catch quotas were established to prevent depletion of these valuable species. On the other hand two fisheries experts, O. Germashev and V. Ovchinnikov, have improved techniques for intense salmon fishing in the Pechora River.

PINRO will publish soon an atlas of commercial concentrations of fish in the White Sea. ("Vodnyi Transport," May 16, 1968.)

* * *

STERN TRAWLER COMPLETES ANTARCTIC RESEARCH

In early May, the 3,200-gross-ton research stern trawler "Akademik Knipovich" completed her third exploratory cruise to Antarctica. The expedition was headed by Dr. A. Lestev of the Laboratory for Fishing Gear and Techniques of VNIRO (All-Union Scientific Research Institute on Sea Fisheries and Oceanography).

Research involved oceanography, biology, ichthyology, and surveys for new fishing grounds in the southern seas. The Akademik Knipovich called at the Falkland and S. Georgia Islands, and Uruguayan and Argentine ports on her way home. ("Vodnyi Transport," May 7, 1968.)

* * *

A. KNIPOVICH' STUDIES KRILL

The primary purpose of the third cruise of the A. Knipovich, which began Dec. 1, 1967, at Sevastopol, was to study krill resources in the South Atlantic. It is likely to be the last cruise to study this subject, which has engaged many VNIRO scientists for the past 4 years.

The Soviets have found it technologically difficult to make fish meal out of krill--and even more difficult to sell at home edible products experimentally produced from krill. ("Vodnyi Transport," May 7, 1968.)



Norway

THE WINTER HERRING FISHERY

The herring fishery of Norway is divided into four distinct types--small, fat, winter, and fjord herring. Winter herring are mature herring older than five years. They constitute the largest part of the total herring catch (about one-third) and are by far the most

Norway (Contd.):

valuable. The 1968 winter herring fishery was a complete disaster. The first quarter of the year is the main season.

Winter Herring Catch, Jan.-March 1966-68			
	1968	1967	1966
	... (1,000 Metric Tons) ...		
Used for:			
Iced for export	2.5	15.3	17.7
Frozen for export	3.6	29.5	35.2
Salted	1.6	13.9	17.6
Smoked	0.7	4.4	4.4
Canned	1.2	7.9	8.1
Industrial use	2.4	283.4	321.8
Bait	-	0.7	3.0
Fresh domestic consumption	2.3	1.9	1.9
Total landings	14.4	357.1	409.7

Notes: (1) Original data in hectoliters (hl.)--converted to metric tons using 93 kilos=1 hl.
(2) Totals may not add due to rounding.
Source: "Fiskets Gang," March 7, 1968, No. 10.

* * *

POOR HERRING CATCH HURTS CANNERS

The 1968 catch of winter herring was the lowest yield recorded in this century with a total catch of about 25,600 metric tons, compared with 372,000 tons in 1967. This poor yield cannot be entirely attributed to the extremely bad weather conditions, but the fishery experts have not yet presented their views and explanations for other possible reasons. Although only about 10 percent of the year's catch was processed for fish meal and fish oil, it is a fact that Norway has had the lowest pack on record. The industry can now only rely on raw material from the North Sea herring for further production of kippers. Final pack figures are not yet available as some canners may still have small stocks of deep-frozen raw material.

The total failure of the herring catch has completely changed the picture as regards soft herring roe. Whereas in 1966 and 1967 there were surplus stocks of soft herring roe--with the exception of $\frac{1}{2}$ ovals during the latter part of 1967--stocks are now, at the beginning of a new sales year, practically depleted, a situation which North Sea herring can in no way rectify as this type of herring does not carry any soft roe of commercial value.

In the absence of herring, the factories have been occupied with sild sardines, mostly from deep-frozen stocks of raw material.

Thus stocks of sild sardines are at present slightly in excess of stocks at the same time last year.

Estimated exports in standard cases of quarter cans of the industry's main items as of March 29, 1968, show:

	1968	1967
Brisling	72,000	98,000
Sild	272,000	234,000
Kippers	54,000	61,000
Soft herring roe	19,000	25,000

* * *

PROTAN FREEZING METHOD IMPROVED

"Protan" is the name of the Norwegian-developed process used to freeze, in alginate jelly, round herring and blocks and to glaze some fishery products. ("Norwegian Fishing and Maritime News," No. 1, 1968.)

The object is to prevent rancidity and drying out in the frozen product during long-term storage. A new-type jelly does not require special proportioning apparatus. Only a large tank with a mechanical mixer to dissolve the powder is needed. Protection is achieved by surrounding the frozen product with a coating or film of alginate jelly. This excludes air, the cause of deterioration in the quality of products during storage at normal temperatures.

The Method

Fresh fish or fillets are dipped or put into a solution of Frostgel Powder. Later, they are packed in lined frames, or in the packaging in which they will be frozen. During freezing, the solution will become jelly-like. Finally, it will become an ice-hard mass practically impenetrable to air. During thawing, the jelly returns to a thick liquid easily washed off with water.

Freezing of fish or fillets in Protan jelly must take place in plate freezers or tunnel freezers equipped to permit freezing of blocks under pressure. If freezing is not done under pressure, the fish will be forced up from the jelly during freezing and lie at the surface of the blocks without protection.

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Norway (Contd.):

Basking Shark Fishery

The Norwegians have hunted the basking shark for centuries. It has always been for the liver primarily. In earlier times, however, they also used the meat--both as human food (dried) and as fertilizer--and the skin for ropes and shoes. The liver oil was used as lampfuel and for tanning. Today, it is refined into various qualities and most of it goes to the cosmetics industry. There the squalene (in which basking-shark liver oil is very rich) forms a vital part of beautifying creams and lotions. The squalene is wonderful stuff, but the limited supply restricts the variety of uses. The liver oil is in high demand and brings a good price.

The Fishery

Today, the fishery is conducted by wooden boats of various types: 50-70 feet, load 20-50 tons, make 8-10 knots, and use a small whale gun. Many fishermen go after both basking shark and small whale.

The season starts in April-May, but sometimes as early as mid-March large schools of basking sharks may be spotted. The peak is usually in June, and the season ebbs in August. Sometimes September may see good catches, but at that time most catchers have switched to other fisheries--shrimp trawling, or "helpers" to the big herring purse seiners.

The basking shark is caught all along the coast of Norway, from the Kattegat to the Barents Sea, and on the banks of the North Sea. Some of our fishermen go as far as west and south of Ireland, much to the irritation of the Irish who sit on shore, waiting for the shark to come to them. The Shetland-Tampen area and the banks off Nordland and Troms are the main hunting grounds.

Little Known About Shark's Habits

Little is known about the habits of basking sharks. Two theories have been put forth regarding their migrations. As they usually are first encountered off Ireland, then on the North Sea banks, and last off northern Norway, it was accepted that the fish spent the winter in the southern part of their distribution area, and moved north in the summer to return in the fall. But closer investigations found large schools of basking shark off Finnmark sometimes as early as March, and this did not agree well with the long south-north migration theory. On the basis of new data, a new theory was formed: The fish are more

stationary. As a rule, they form various local populations with in their distribution area. The whole North Atlantic, north of the tropics, and the Mediterranean are considered one distribution area. The fish stay in holes and trenches along the edge of the continental shelf in a kind of hibernating condition. They live on the energy accumulated in the liver. When the plankton blossom in spring and summer, the fish come up and over the banks to the coast.

To find the truth, we must tag the fish. Both England and Norway have tried to tag basking sharks. No experiments have been successful yet, but we hope to tag a few this summer (1968).

Equipment Used

A small whale gun is used to take the fish, but the harpoon and wire differ from whaling equipment. Figure 1 shows the rigging of the sharking equipment. The harpoon (figure 1 A) weighs 18 kilos. A steel wire of about 20 meters is fastened at its balance point. The wire is sheakeled to a thick, very elastic, nylon rope, and fastened about the bow outboard with easily-breakable string (figure 1 B). The nylon rope goes over a block, hanging from a gallow or standing on the rail on starboard, along the deck, over a block beside the wheelhouse and up to the winch (figure 1 C).

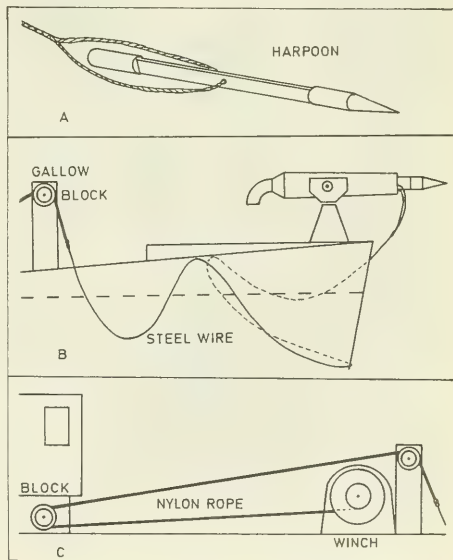


Fig. 1 (a, b, c) - Rigging of the sharking equipment.

Norway (Contd.):



Fig. 2 - Combined trawler and basking shark hunter.



Fig. 4 - Ready to fire. Shark's shadow may be seen right under bow.

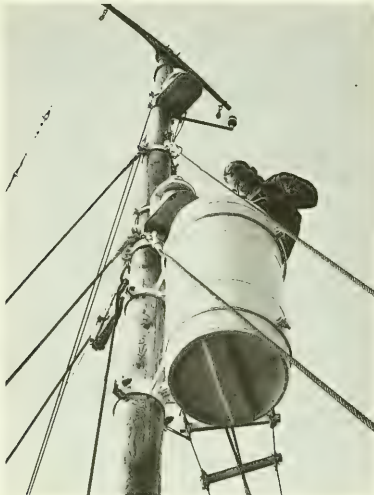


Fig. 3 - The lookout in crow's nest.



Fig. 5 - Killing shark with a carbine bullet.

Norway (Contd.):



Fig. 6 - Trying to get a loop around a pectoral fin.

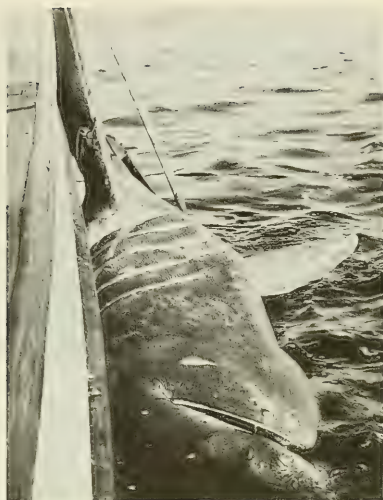


Fig. 8 - Taking out the harpoon. Skin shows uneven distribution of pigments.

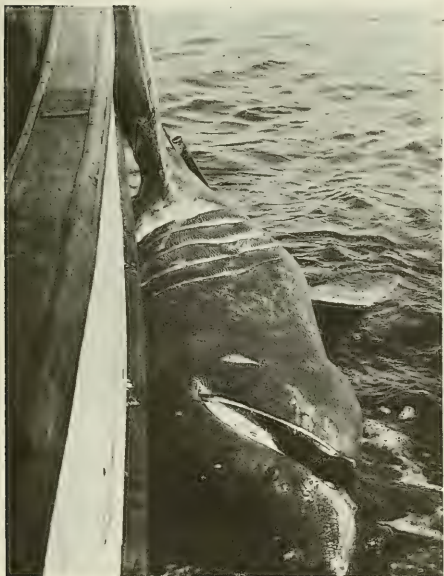


Fig. 7 - Hanging in a loop by the pectoral fin.



Fig. 9 - Cutting out the liver.

Norway (Contd.):



Figs. 10 & 11 - Heaving liver on board and dropping it into hold.



Fig. 12 - Basking shark fleet at Traena on Arctic Circle (midnight June 27-28, 1967).

Norway (Contd.):

Fishing Technique

The boats are manned by 3 to 5 fishermen, who sail out to the grounds where tradition has it basking sharks should be at the time. They also cooperate with other fishermen, who will call them by radio if they see anything. The basking shark hunters have accumulated knowledge through generations, and their strong intuition impresses an outsider. But very little has been written down.

The fishery demands good weather because fishermen depend on seeing the dorsal or upper caudal fin above water. When the wind is fresh (force 5), one usually has to give up. Everybody on board is on the lookout for the black triangle that means fish. There is a crow's nest in the main mast, and many boats also have a wind screen and an extra wheel on top of the wheelhouse, so the helmsman too gets a better view.

Shark Ahoy!

On spotting a fish or a school, the gunner runs to the bow. They close in on the fish from behind. If there is a school, they choose the hindmost fish, hoping not to scare the others down at the first shot. If the fish goes down and no fin can be seen, the lookout in the crow's nest can still direct the chase as long as the fish stays just under the surface. But that is the limit; if the fish goes deeper, the fishermen can only wait. The harpoon would lose its momentum in the water, and there is no use firing unless the fish is close to the surface.

One does not fire until close upon the fish. One aims at the thickest part of the fish, and the harpoon goes right through the body. The harpoon, which is attached to the wire at balance point, will lay at a right angle to the wire when hauled in and make a good stopper. If the harpoon does not go right through, it may be pulled back the way it went in, and the fish will be lost.

Coup de Grâce

The hauling in starts immediately. When the fish is under the starboard bow, the gunner kills it with a carbine bullet through the brain. This may be difficult and will take some time if the fish keeps its head down. All

the splashing and fighting, and the risk of being hit by the tail while leaning out over the rail, make it difficult and dangerous.

When the fish is dead, a loop is put around one of the pectoral fins, and the fish is thus turned belly up. Now hanging by the loop, the harpoon wire is shackled out. The harpoon is taken on board by a long hook, and the wire is hauled through the fish. When this is done, the gunner cleans and reloads the gun. He uses 40 grams of black gun powder. The belly is cut open by a long knife and the liver taken out. When the liver floats freely, the body is let go. The liver is cut into pieces, hauled on board, and dropped into the hold.

The whole operation, from the time trigger is pulled until crew is ready for the next fish, may take only 6 minutes under ideal conditions, I have been told, but an average of 15 minutes should be a realistic estimate.

The hunt is best in the morning and in the evening. Usually, there are few or no fish to be seen about noon. So the fishermen take 2-3 hours siestas and get a very welcome rest--because the fishery begins at 5 in the morning and often lasts until midnight.

The Industry

The fishermen have an organization in Brandal (Aalesund). When the boats are loaded, they contact the office, which directs them to one of the three factories that process basking shark liver oil, usually the nearest one. These factories are at Hagesund, Flesland (Bergen), and Brandal. The whole year's catch is sold beforehand at an agreed price based on 70% oil content; the price varies with the percentage.

The basking shark fishery is becoming popular as the oil price goes up. In 1967, 53 boats achieved a fine record: over 2 million kilos of liver, about the same as the record year of 1960. In 1966, 30 boats produced about 900,000 kilos of liver. The coming season may see a hundred boats on the hunt. Research should be intensified to find the optimum yield.

--By Sigmund Myklevoll
Research Assistant
Institute of Marine Research
Bergen, Norway



East Germany

RATES THIRD IN WORLD SHIPBUILDING FOR FISHERIES

The shipyards at Rostock, Wismar, and Stralsund in East Germany are continuously building new fishing and research vessels. Over 14 percent of the world's fishing vessels are built in East German shipyards. The nation now holds 3rd place in world fishing-vessel construction.

Recently, 150 fishing vessels with a total gross tonnage of 170,000 were ordered by various countries. One of East Germany's largest customers is the USSR--42 vessels were built for her in 1967. ("Vodnyi Transport," Oct. 7 and 26, 1967.)



France

STRIKES LIMIT IMPORTS OF FISHERY PRODUCTS

Strikes developed in the French fishing industry during the second half of February. They started in the Mediterranean ports to protest low prices for sardines. They spread to the North Sea industrial ports, where strikers sought to obtain proper controls over improper and uncontrolled imports of basic fishery products.

The fishermen of Marseilles requested the establishment of a compensation fund to support the sardine market, a fixed sale price for sardines, and a freeze on sardine imports.

The fishermen of Boulogne, Dunkerque, Dieppe, Fecamp, Cherbourg, and other northern fishing ports requested, under article 44 of the Treaty of Rome, that the minimum price system be extended to other fish species to give the market a "shot in the arm."

Government Acts

The strikes were settled only after the French government decided to take measures to protect the sardine fisheries; also, to establish immediately minimum import prices for 5 more fish species. On February 27, the French "Official Gazette" began publishing the new minimum import prices. At the same time, appropriate steps were taken at the European Economic Committee.

By the setting of firm controls over imports--and by regulating the domestic sardine market--the worries of the industry were eliminated. ("La Pesca Italiana," April 4, 1968.)



Iceland

SHIPBUILDING IS INCREASING

Until a short time ago, Iceland ordered nearly all her steel-hulled vessels abroad. Now the domestic building of these vessels is increasing.

Recently, 2 steel-hulled fishing vessels were launched for Icelanders. The vessels totaled over 360 gross tons. There also are plans to build 2 coastal vessels in the Akureyri shipyard, though vessels of that size always were built abroad.

Many Icelandic fishing vessels have been built in Norway in recent years. For example, Kaarbos Mekaniska Verksted recently launched the twelfth and started immediately on a thirteenth. ("Atlantic and Iceland Review," No. 1, 1968.)

* * *

NEW OCEANIC RESEARCH SHIP PLANNED

Preparations to build a new Icelandic oceanic research vessel for launching in 1969 are under way. It is to be named "Bjarni Saemundsson," after a pioneer of Icelandic fishery research.

The vessel will be about 800 gross tons and equipped with 3 main engines driving dynamos that will provide its power. This will be the first electrically propelled vessel in Icelandic ownership.

Very Modern Vessel

The equipment is designed to eliminate vibration and provide better conditions for research on board. One novelty is mounting fish-locating apparatus on a movable platform. The platform remains level when the ship rolls, so radar search-beams are not affected. Only one other vessel so equipped has been built in Western Europe.

* * *

Iceland (Contd.):

1967 HERRING CATCH WAS LOW

In summer 1967, 160 herring vessels fished from Icelandic ports, 60 fewer than in 1966. The season's fishing was characterized chiefly by the great distance vessels had to go to fish; often 600-700 miles from the Icelandic coast, all the way to Spitzbergen. The herring vessels also fished off Shetland and landed some of their catch abroad.

Catch Nearly Halved

In late December, the catch had reached 343,000 metric tons, considerably less than the 1966 period's 667,000 tons. Of this, about 288,000 tons were used for meal and oil and over 300,000 barrels were salted.

* * *

STOCKFISH EXPORTS DROP

The year-old Nigerian civil war has seriously affected one of the most important markets for Iceland's stockfish. By far the greatest part was sold to Nigeria, a substantial quantity to Italy, and a little to Sweden. In 1966, 8,217 metric tons were sold to Nigeria, while in 1967 only 2,188 tons. As a result, unsold stockfish now amount to 6,300-6,600 tons.

Producers Ask Government Help

The stockfish producers have to pay interest on loans and meet large storage costs for stocks. They do not know when, or at what price, they will sell them. So they have asked Government aid.

Uncertain Future

Even if the Nigerian war ends soon, some time is likely to elapse before normality returns. Moreover, market prospects have not been improved by the recent increase of import duty on this article. An attempt has been made to find new markets for stockfish in other African states, but so far without much success.



Sweden

FISHERMEN HAVE MARKET PROBLEMS

Swedish fishermen are experiencing serious difficulties because of a poor supply of fish--North Sea herring normally landed directly in Danish ports--and low prices in domestic and foreign market. Representatives of fishery organizations claim that Swedish fishermen during the last two years have suffered a 30-percent reduction in salary.

The present situation is considered the most critical for fishermen in 30 years. Relatively large investments in craft and gear have resulted in severe effects in many cases. Owners of large steel trawlers report that income during the last few months did not cover interest on loans which, in many cases, exceed US\$193,000.

Foreign Devaluation

The marketing difficulty is not the only problem. Reportedly, fisheries in other Western European countries have encountered sales difficulties and low prices, both for fresh fish and prepared fish products. Swedish fishermen claim that one reason for the severe situation is the increasing import of fish and fish products. The devaluation in Denmark, Iceland, and Great Britain last fall has resulted in rapid expansion of imports from these countries. Direct landings in Denmark by Swedish fishermen are now less profitable. Trade in fish products for 1967 produced an import surplus of US\$26.7 million, compared with only US\$14.3 million in 1965.

An example of the marketing difficulties facing Swedish fishermen was illustrated in Goteborg recently, when 25 metric tons of fish, mackerel, and cod intended for human consumption remained unsold. These had to be turned over to a fish meal plant. (U. S. Consul, Goteborg, May 6, 1968.)



United Kingdom

FISHING INDUSTRY TO GET INCREASED SUBSIDIES

The British fishing industry will receive increased subsidies as soon as details are worked out. Current proposals call for increased loans for new vessels in both inshore and herring fleets, a more lasting operational subsidy for deep-sea fleet, and elimination of scrapping restrictions. Legislation also will be introduced in Parliament to end the automatic reduction of operating subsidies in existence since 1961.

Despite these proposed increases, the industry is not quite satisfied. It wants some limitation on imports. (U. S. Embassy, London, May 18, 1968.)

* * *

MARINE OILS GAIN AT HOME

The highlight of British consumption of fats and oils last year was a considerable increase in use of marine oils (prices have been falling) and a decline in vegetable oils. Trade in fats and oils reflected the consumption pattern; imports of marine oils went way up. Two chief uses of fats and oils are in margarine and cooking fats. The switch from vegetable to marine oils is most evident.

Fish Oil Price Falls

The price of fish oil declined steadily during second-half 1967, Peruvian oil dropped from US\$142 a long ton in June to \$103 a ton in December. By April 1968, the price was down to \$93. Whale oil prices show similar downturn. A recent purchase of 16,000 tons of whale oil--half from USSR and half from Japan--reportedly cost \$103.20 a ton. This compares with almost \$144 a ton for 34,500 tons in 1967.

Marine Oil Imports Rise

Imports of marine oils during 1967 went up 60 percent--to 281,900 long tons. Purchases of whale oil and fish oil increased, the latter by 53 percent. Stocks of marine oils at year end reached a very high level of 67,300 tons, compared with 28,200 a year earlier.

Total use of marine oils in 1967 did not rise as much as imports--only 13 percent above 1966 level. Because of their improved competitive position, these oils most likely will gain in British fats and oils market. ("Foreign Agriculture," May 27, 1968.)

* * *

NEW BOOK ON FISH FARMING

"Farming the Edge of the Sea," by E. S. Iverson, is a valuable book for persons interested in sea farming. It covers the present status of the industry and describes many farmed species. It looks at the biology of each species, describes the farming procedures, emphasizes the problems encountered, and discusses expansion in the years ahead. Also, it evaluates the practicability of farming species not yet farmed.

The book is available from Fishing News (Books) Ltd., 110 Fleet St., London E. C. 4, England, at US\$10.50.



Poland

BUILDS NEW SERIES OF STERN FREEZER TRAWLERS

The Polish Design and Research Center at Gdynia has designed a new class of freezer trawlers. The first 800-displacement ton unit in this series was scheduled for launching by the Gdynia Shipyard in May. The new (B29) stern freezer trawler is intended to fish in the North and Central Atlantic for bottom and pelagic fish. The vessel is 246 feet long, will have crew of about 60, sea endurance of 60 days, and holds with over 1,000 cubic meters of space.

The trawler has 2 continuous decks--a main and a work deck, and a 3-tier superstructure. The work deck length from stern ramp to trawl winch is about 118 feet. This simplifies handling of fishing gear. She is built and equipped to fish, process and fillet, freeze, and produce fish meal.

The propulsion machinery is remotely controlled from a console in a separate

Poland (Contd.):

soundproof control room located in the engineroom--or from a console in the wheelhouse, where a trawl winch control console is also located.

Processing Fish

While designing the trawler, special attention was paid to the transport and processing of fish: (1) The transport of fish between sorting room, refrigeration space and holds, and transport of offal to fish-meal plant and of ice to the sorted fish containers, is mechanized. Different types of conveyors are used. The fish working rooms are adapted for partly mechanical sorting of fish. (2) The new trawler is equipped with vertical contact plate freezers with a capacity of 30 tons per 24 hours using Freon 12. Two Bader 33 filleting machines will also be installed. To utilize fish offal, a fish-meal plant capable of processing 25 tons per 24 hours will be provided. Two flake ice producing machines will have a total output of 16 tons per 24 hours. The fish will be kept in holds refrigerated down to -18.4° F. by Freon 12-using equipment.

The first 8 units of the new series of freezer sterntrawlers have been ordered by Polish owners. The vessels are scheduled for delivery between 1968 and 1969. ("Polish Maritime News," May 1968.)



Denmark

THE 1966-67 MARINE OIL MARKET

In 1967, production of crude marine oils, mainly herring oil, increased by 25,549 metric tons to 62,686 tons. Imports were down 2,813 tons to 20,236 tons; Iceland was the main supplier. Exports increased 28,394 tons to 62,608 tons; the United Kingdom was the main customer. Consumption declined 3,441 tons to 22,328 tons in 1967.

Production of hardened and refined marine oils and animal oils was almost unchanged in 1967. Imports increased 51 percent to 19,001 tons. Peru supplied refined marine oils, and Norway and Sweden hardened oils. Consumption increased 5,423 tons to 40,014 tons in 1967, compared with consumption of 17,965 tons in 1966.

Supply of Marine Oils, 1966-67							
	Stocks Jan. 1	Production	Imports	Total Supply	Exports	Consumption	Stocks Dec. 31
..... (Metric Tons)							
MARINE OILS:							
Crude:							
Fish Oil (incl. herring oil):							
1967	5,464	62,684	19,426	87,574	62,279	21,822	3,473
1966	5,286	37,037	21,701	64,024	33,385	25,175	5,464
Whale Oil:							
1967	155	2	0	157	0	25	132
1966	130	100	0	230	4	71	155
Other Crude Marine Oil:							
1967	1/	1/	810	810	329	481	1/
1966	1/	1/	1,348	1,348	825	523	1/
Total Marine Oils, Crude:							
1967	5,619	62,686	20,236	88,541	62,608	22,328	3,605
1966	5,416	37,137	23,049	65,602	34,214	25,769	5,619
Marine Oils & Animal Oils, Hardened or Refined:							
1967	1/	2/22,000	19,001	41,001	987	40,014	1/
1966	1/	2/22,000	12,609	35,609	1,018	34,591	1/

1/Not available.

2/Preliminary.

Source: U. S. Embassy, Copenhagen, April 18, 1968.



LATIN AMERICA

SPINY LOBSTER FISHERY

U. S. Embassy reports from Brazil, Colombia, and the Dominican Republic provide these important data on the spiny lobster fisheries of the 3 nations:

Brazil

The Brazilian spiny lobster fishery is open all year, except for 2 areas where fishing is prohibited:

- (i) Between latitude 33,30° and 7,50° S., and
- (ii) Between longitude 39,7° and 38,48° W., to 3 miles from shore.

Lobsters must have a minimum size of 50 millimeters cephalothorax measurement.

The fishery includes 30 vessels of 15 meters or over, and 120 under 15 meters (49 feet). These are manned by an estimated 500 fishermen.

Recent export prices were US\$1.25 to \$1.40 a pound.

Annual catches have been:

State	1967	1966	1965	1964	1963
	. . . . . (Metric Tons)				
Ceara	1/	1,103	1,559	1,332	1,592
Pernambuco	1/	707	547	423	247
Rio Grande do Norte	1/	864	1,180	1,451	1,504
Other	1/	56	44	45	191
Total	2/1,007	2,730	3,330	3,251	3,534
1/Not available.					
2/Estimate.					

Exports:

Year	Fresh, Chilled, or Frozen ^{1/}		Value Total Exports
	Total	To U. S. A.	
	. . . (Metric Tons) . . .		US\$Millions
1967	975	974	2.7
1966	1,123	1,116	3.8
1965	1,181	1,174	3.6
1964	1,577	1,573	2.6
1963	1,778	1,775	3.5
1/Fresh and chilled, probably whole lobsters, and frozen, mostly tails. No breakdown available, though bulk of exports are assumed to be mostly frozen tails.			

Nominal exports, 1 to 16 tons a year, have been made to Argentina, Spain, the Netherlands, and Sweden.

Plans for Future Production

The catch has been declining due either to migration of lobsters or overfishing, or both. It is not expected to exceed 1,700 tons a year over the next 5 years. It is anticipated that 99 percent of the exports will continue to go to the U. S. (U. S. Embassy, Rio de Janeiro, May 17, 1968.)

Colombia

Little spiny lobster fishing is done on the Pacific coast. Most lobsters are caught on the Atlantic coast.

The Colombian Ministry of Agriculture reported these landings of spiny lobster:

	Metric Tons
1967	22
1966	21
1965	19
1964	17
1963	16

Export figures are not readily available. However, the following data indicate the export level. Most frozen lobsters are exported. Colombia does not catch lobster.

	Metric Tons
1967	16
1966	15
1965	14
1964	13
1963	10

Laws About Lobster

Colombian law prohibits lobster fishing from April 1 to Aug. 31 in the Atlantic littoral; forbids catching, of lobsters under 25 centimeters; and requires that a certain percentage of the catch, in practice seldom more than 20 percent, be made available for national consumption. Fines for violations of the first 2 articles may range from 1,000 to 100,000 pesos (US\$80-8,000).

The Fishery

About 400 fishermen, mostly Indians from Guajira, fish lobsters. They use small boats and dive for lobsters. Current Bogota price for lobster is 32 pesos (US\$2.50) a pound.

Colombia (Contd.):

Almost all lobster fishing is done off the Guajira coast in the Atlantic, particularly in the Cabo de Vela area. Some lobster fishing is done off Tumaco near the Ecuadoran border.

The principal exporting firm is Mariscos del Caribe. Two new firms, German-owned, Langosta del Caribe, and Guajira Costa Norte, plan operations soon. (U. S. Embassy, Bogota, May 21, 1968.)

Dominican Republic

The Dominican lobster fishing season runs from Jan.-Feb. and Aug.-Dec. The number of lobster fishermen is not known, but the total number of all types of licensed fishermen is 5,364.

Prices are approximately \$0.72 per kilo (\$0.33 a lb.). The number of vessels of all types in 1967 was 1,422. There is no break-down for lobster vessels only. Areas of greatest activity are the waters around ports of Sanchez, La Romana, and Pedernales.

Fishery Limited

Due to the narrow under sea shelf surrounding the Dominican Republic, the areas where spiny lobsters may be taken are definitely limited. As a result, there is little possibility of substantially expanding the catch. The Dominican Republic cannot be considered a potential supply source of any importance for the U. S. market. (U. S. Embassy, Santo Domingo, May 19, 1968.)

Annual Catch					
1967	1966	1965	1964	1963	1962
..... (Metric Tons)					
62.8	92.1	73.6	76.1	56.0	42.8
Exports					
			1967	1966	
			..... (Metric Tons)		
Frozen lobster	.....		19.6	30.4	
Live lobster	.....		-	1.2	
Lobster tails	.....		1.7	1.1	
Note: All shipped to Puerto Rico in 1966; Puerto Rico and Curacao (0.2 tons) in 1967.					



Mexico

NEW MARINE SCIENCES SCHOOL OPENS IN MONTERREY

On April 19, 1968, the Monterrey Institute of Technology and Superior Studies officially inaugurated a new school of marine sciences; the Escuela de Ciencias Maritimas y Tecnologia de Alimentos Guaymas. Present were 200 guests. The Rector said that the school would grant degrees in marine sciences. Through fisheries research, it would seek to provide more food (from Gulf of California) and serve the economic needs of Mexico.

The School

The new school is a 2-story, concrete building 100 yards from the sea. The first floor has an aquarium; biology lab; a food-analysis lab; and a small but good pilot plant for experimental food production. The plant includes a large storage freezer, fast freezer-dryer, a thermal dryer, and a vacuum can sealer. On the second floor are 2 spacious lecture rooms, a modestly equipped oceanographic lab, a library, offices, and physiology and biochemistry lab. The labs can accommodate about 30 students each. Almost all equipment is U. S. manufacture, with a few Japanese meters and Swiss analytical balances.

61 Students

The school has operated a full semester with 61 students and 7 teachers. Next semester there will be about 100 students. The capacity of about 200 should be reached shortly thereafter. The director is Dr. Henry J. Schafer, a Mexican, with PhD from the University of Miami.

Land Donated

The land for the school was donated by a private citizen. The Ford Foundation contributed US\$175,000, the Inter-American Development Bank US\$200,000, and the Institute the rest.

The school is well coordinated with other institutions in teaching marine sciences,



ASIA

Japan

CONTINUES ALBACORE PRICE STABILIZATION PROGRAM

The Federation of Japan Tuna Fishermen's Cooperative Associations (NIKKATSUREN) plans to implement again in 1968 the albacore price stabilization program. Under this program, developed in 1965, NIKKATSUREN buys and stores albacore when heavy summer landings threaten to reduce prices below a certain level. The fish are released later, at home or abroad, when they would not glut the market. In 1966 and 1967, NIKKATSUREN had little need to do this because of high prices.

Albacore Season Starts Slowly

This year, the summer albacore fishery is off to a slow start. The outlook is not promising. So, depending on the season's outcome, NIKKATSUREN again may not have to carry out its program.

In 1967, the organization purchased 181 tons of albacore, which were processed into canned tuna in oil and sold at home. ("Katsuo-maguro Tsushin," May 7, 1968, and other sources.)

* * *

CANNED PINK SALMON PRICE REDUCED

The Japan Canned Salmon and Crab Sales Co., Ltd., announced on April 1 an advertising allowance of US\$1 a case on canned pink salmon, No. 2 cans ($\frac{1}{2}$ -lb. flat). Quotations for areas A and C (U. S. and Canada, and countries other than U. K., Australia, and New Zealand) remain at \$14 for fancy grade and \$13.50 for standard grade.

Opportunity Missed in 1967

In summer 1967, there was some demand for Japanese canned pink salmon in the U. S. If the sales company had deducted \$1 from the public quotation (trading companies wanted this), a considerable amount could have been sold there. The land packers, however, never agreed, although the ocean packers wanted to dispose the stock at the reduced price.

* * *

12 BOTTOMFISH MOTHERSHIP FLEETS WORK IN BERING SEA

The 12 Japanese mothership fleets licensed for the 1968 Bering Sea bottomfish fishery were operating full scale with the arrival of the last mothership. The latter left Japan April 27. The fleet catch, Jan.-April 1968, was about 200,000 metric tons--about 45,000 tons ahead of the same 1967 landings of 156,500 tons. There is considerable interest in whether the Bering Sea fleet this year can equal or surpass the 1967 record catch of 770,000 metric tons of bottomfish. ("Suisancho Nippo," May 1, 1968.)

The 1968 Bering Sea mothership fleet and assigned catch targets are:

Mothership	Size		Catch Target
	Gross Tons	Metric Tons	
"Banshu Maru No. 5"	3, 678	5, 620	
"Kanshima Maru"	7, 163	7, 820	
"Kazushima Maru"	3, 757	2, 460	
"Seifu Maru"	8, 269	22, 700	
"Oshima Maru"	Unknown	4, 680	
"Nishin Maru No. 2"	27, 035	127, 400	
"Soyo Maru"	11, 192	115, 990	
"Gyokusei Maru"	10, 357	148, 140	
"Shikishima Maru"	10, 144	103, 200	
"Hoyo Maru"	14, 094	121, 717	
"Chichibu Maru"	7, 472	8, 000	
"Kotoshiro Maru" 1/	Unknown	Unknown	
Total		667, 727	
1/Probably "Kotoshiro Maru No. 28" (572 gross tons).			

* * *

1968 SALMON DELIVERY PRICES SET

The Japanese Northern Water Salmon Mothership Association and the National Federation of Salmon Fishing Cooperative Associations (NIKKEIREN) agreed May 13 on 1968 salmon delivery prices. NIKKEIREN represents owners of gill-net fishing vessels assigned to the salmon motherships.

Species	Salmon Price Agreements				
	1968	1967	1966	1965	1964
	(Cents/Lb.)				
Red.	30.7	31.3	31.3	30.7	27.4
Chum.	20.2	19.2	17.9	16.6	14.9
Pink	14.9	14.9	14.4	13.4	11.9
Silver & King	20.9	20.9	19.6	18.1	16.2

The new prices are a 0.6 U. S. cent a pound decrease for reds, and a 1-cent-a-pound increase for chums over 1967 prices. There was no price change for other species. ("Nihon Suisan Shimbun," May 17, 1968.)

* * *

Japan (Contd.):

1968 SALMON QUOTAS ALLOTTED

The 1968 Japanese salmon catch quota of 93,000 metric tons was set at the recent annual meeting of the Japan-USSR Fisheries Commission. It was allocated for Area A (North of 45° N. latitude) and Area B (South of 45° N. latitude) as follows:

Area	Type of Operation	Catch Quota		
		1968	1967	1966
. . . (Metric Ton) . . .				
A	Mothership fishery	37,763	42,635	38,981
	Land-based gill-net fishery	8,737	9,865	9,019
	Total	46,500	52,500	48,000
B	Land-based gill-net fishery	27,420	33,000	28,390
	Land-based long-line fishery	12,180	14,700	12,610
	Land-based vessels under 7 tons	3,950	4,400	4,000
	Japan Sea gill-net fishery	2,950	3,400	3,000
	Total	46,500	55,500	48,000
	Grand Total	93,000	108,000	96,000

("Nihon Suisan Shimbun," May 17, 1968.)

* * *

SALMON MOTHERSHIPS DEPART

Eleven Japanese salmon motherships, accompanied by 369 catcher vessels, departed Hakodate, southernmost Hokkaido, on May 15, 1968, for the fishing grounds in the Bering Sea and North Pacific Ocean. ("Nihon Suisan Shimbun," May 17, 1968.)

Name of Mothership	Size	Owner
	Gross Tons	
"Shinano Maru"	9,048	Nichiro Gyogyo
"Chiyo Maru"	7,149	Taiyo Gyogyo
"Nojima Maru"	8,815	Nihon Suisan
"Meisei Maru No. 2"	9,356	Nichiro Gyogyo
"Jinyo Maru"	7,161	Hokkaido Gyogyo Kosha
"Kizan Maru"	8,622	Nichiro Gyogyo
"Meiyo Maru"	7,152	Hakodate Kokai
"Kyokusan Maru"	10,757	Kyokuyo Hogeai
"Otsu Maru"	8,033	Hoko Suisan
"Miyajima Maru"	9,612	Hokoku Suisan
"Meisei Maru"	8,571	Nichiro Gyogyo

* * *

FROZEN TUNA EXPORTS
DECLINED SHARPLY IN 1967

The Japan Frozen Foods Exporters Association reports that frozen-tuna exports in business year 1967 (April 1967-March 1968) declined sharply. Shipments to the U. S., based on exports approved by the Association,

were 67,787 short tons, down about 30,000 tons from BY 1966 exports of 98,955 tons. The decline is attributed to slow sales in early 1967 and to the record 1967 U. S. skipjack catch of about 103,000 tons.

Exports to Europe Decline

Exports to Europe also dropped sharply. These were 35,536 metric tons, compared with 52,000 tons in BY 1966. Much of this was due to reduction in direct exports from Japan because local demand for tuna was brisk. Direct exports in BY 1967 to Italy declined by about 13,000 tons, and to Spain by 5,000 tons, from BY 1966.

To Overseas Bases

Exports to overseas bases in BY 1967 were about 16,400 metric tons, down about 5,000 tons from BY 1966. This resulted largely from tuna fleet expansion by South Korea and Formosa, and to reduction of Japanese overseas-based fleet. Exports to American Samoa alone decreased by about 3,000 tons from BY 1966. ("Nihon Suisan Shimbun," May 20, 1968.)

* * *

SUMMER ALBACORE TUNA
FISHERY IMPROVES

The Japanese summer albacore tuna fishery, off to a slow start in early April, is improving. Landings at the leading tuna port of Yaizu still lag far behind 1967's--4,108 metric tons during April 1-May 29, 1968, compared with 8,292 tons in 1967 period. But vessels were returning to port in late May with larger albacore catches. So prices have dropped somewhat.

Prices Drop Slightly

On May 29, pole-caught albacore of 37-40 pounds were sold at US\$469-474 a short ton, ex-vessel, compared with earlier prices of around \$500 a ton. In view of improved prospects, one Yaizu tuna packer, who had agreed to a rotation system of buying to keep prices from advancing further, decided to discontinue the practice. ("Suisancho Nippo," May 30.)

* * *

Japan (Contd.):

YAIZU'S APRIL LANDINGS RISE

April 1968 fish landings at Yaizu totaled 16,368 metric tons worth about US\$6.13 million, according to the Yaizu Fishery Cooperative Assoc. Compared with April 1967, this was an increase of 1,624 tons and \$580,000. ("Suisancho Nippo," May 9, 1968.)

	Quantity			
	1968		1968	1967
	April	March	Jan.-Apr.	April
	. . . . . (Metric Ton)			
Tuna:				
Bluefin ^{1/}	5,133	4,906	18,859	4,734
Albacore	1,241	1,521	3,958	2,412
Skipjack	5,686	4,717	17,981	3,206
Mackerel	3,650	5,288	13,783	3,757
Others	658	570	2,255	635
Total	16,368	17,002	56,836	14,744
	Average Price			
	1968		1967	
	April	March	April	
	. . . (US\$/Short Ton) . . .			
Tuna:				
Bluefin ^{1/}	617	670	570	
Albacore	406	358	405	
Skipjack	242	214	258	
Mackerel	88	93	96	

^{1/}Includes yellowfin and big-eyed tuna.

* * *

FROZEN TUNA EXPORT PRICES
TO U. S. IN MAY

The Japan Frozen Tuna Exporters' Assoc. reported these May frozen tuna export prices to U. S.:

Species	Prod.	Low	High	Avg.
		(US\$/Short Ton f.o.b. Japan)		
Albacore	Rnd.	460 (380)	470 (410)	465 (404)
Yellowfin	gilled & gutted	354 (320)	380 (395)	373 (339)
Albacore	loin	940 (806)	975 (850)	952 (837)
Yellowfin	loin	820 (722)	835 (770)	829 (753)

Note: May 1967 prices in brackets.

Source: Fisheries Attaché, U. S. Embassy, Tokyo, June 7.

* * *

INCREASES TRAWLING
OFF U. S. EAST COAST

In mid-March 1968, the Japanese Nihon Suisan Fishing Co. sent its 2,500-gross-ton trawler "Kiso Maru," based at Las Palmas, off the U. S. east coast to explore its commercial potential. In April, that firm sent another 2,500-ton trawler ("Kaimon Maru") on a similar expedition. On May 8, Nichiro Gyogyo's "Akebono Maru No. 51" (1,500 gross tons) left Shimonoseki for exploration off Florida coast. A Nichiro-affiliated firm is expected to send its trawler "Chitose Maru No. 18" (1,800 gross tons) to that region. Taiyo Gyogyo was scheduled to dispatch its 1,800-ton trawler "Taiyo Maru No. 65" from Las Palmas on May 10; in late May, 1 or 2 more expeditions were planned. Nihon Suisan also plans to send one more vessel. Thus, 8-9 commercial trawlers will be exploring off U. S. east coast this year.

1966-67 Explorations

The U. S. Atlantic coast was explored in 1966 by Taiyo's "Taiyo Maru No. 32" (369 gross tons) and, in 1967, by Nihon Suisan's "Kaimon Maru" (2,500 gross tons) operated under charter to the Japan Overseas Trawlers Association. Taiyo's expedition was disappointing, but Nihon Suisan's trawler discovered good trawlable grounds; in particular, the abundance of butterfish and squid near 30° N. latitude off New York revealed feasibility of commercial operations.

Questions remain: (1) Are the fishing grounds broad enough to support simultaneous operations of about 10 Japanese trawlers? (2) To what extent can Atlantic-caught butterfish and squid be sold in Japan? (3) Can region be fished on sustained basis in competition with other foreign vessels? (4) Can trips be shortened to reduce costs? These and other problems involving marketing must be resolved before the region can be developed into a third major area for the Japanese trawl fleet. ("Minato Shimbun," May 9, 1968.)

* * *

Japan (Contd.):

CONTAINER SHIP LAUNCHED

Japan's first container ship, the 16,800-gross-ton "Hakone Maru," was launched May 17, 1968, at the Mitsubishi Heavy Industries Shipyard. Scheduled to be placed in service from Sept. 1 this year, she will call at San Francisco and Los Angeles on her first trip to North America.

The Hakone Maru will transport frozen tuna and other frozen fishery products to the U. S. She will carry back such imports as shrimp, beef, and lemons. The vessel has a carrying capacity of 15,800 tons, will carry 266 containers on deck, and has top speed of 26 knots.

She is one of 6 Japanese container vessels scheduled for the North Pacific route this year. ("Suisan Keizai Shimibun," May 21, 1968, and other sources.)



Thailand

U. S. AIDS INLAND FISHERY DEVELOPMENT

The U.S. Agency for International Development (AID) plans about \$250,000 in technical fishery assistance, from mid-1968 through 1971, to the Thai Government in the "sensitive" Northeast Provinces. Thailand's contribution will be about \$1 million: \$211,000 in counterpart funds, and \$750,000 in budget authorizations.

The project's purpose is to increase fresh-water fish production in the Northeast Provinces. This would increase the supply of high-protein food and the cash income of farmers. AID proposes to expand and improve the capabilities of the 8 Northeast provincial fishery stations; promote better training programs; expand research at the Bangkok Central Research Station, and survey the Northeast for areas suitable for small-scale fish culture.

Proposed Extension Service

Plans include establishment of an extension service. Eight 3-man mobile units will be set up to demonstrate the best use of irrigation for rice paddy fish culture, pond and

floating-basket pisciculture. Advice and training on fish culture will be provided. Fish fry will be supplied to village farmers at the lowest possible cost. (Present cost: \$10 per 100 fry.)

Proposed Research

In the research proposed by the plans, specialists will experiment at the Aquiculture Section at Bangkok; study methods of breeding species of fish suitable for production in Northeast Thailand; survey the prospects of making natural bodies of water suitable for fish culture.

The AID project aims at increasing fishery consumption in the Northeast in a relatively short time through effective extension work. Fish consumption now represents only 6 percent of the area's total protein requirement; in the Central Plains, fishery products already provide as much as 54 percent of all protein needs.

Mobile Units to Reach Many

The mobile units are expected to reach 250,000 to 500,000 villagers, in addition to those reached by the fishery stations. They are also expected to triple the fry distribution. In 1967, the stations distributed 2.25 million fry. During 1968-71, extension and research specialists at each station will receive more training in planning construction of fish ponds with village leaders, and in instructing farmers to breed fish in ponds and paddies. Planned for 1968-70 are 1,000 field demonstrations in pond and paddy fish culture.

Experimental fish culture in rice paddies has already been quite successful because farmers have paddies and need not wait for excavation of ponds. Experience shows that 55 to 1,250 pounds of fish per acre of rice paddy can be grown.

The Thai Department of Fisheries has already long-term plans for fresh-water fishery development. The target now is to increase annual production by 16 percent, from 86,000 metric tons in 1965 to 100,000 tons in 1971. Most of this increase will be generated in the Northeast.



Malaysia

BRUNEI PROMOTES FISHERIES RESEARCH

The Brunei (Malaysia) Fisheries Department's program to survey the deep-sea resources outside Brunei waters is now well underway.

A research trawler of the Malaysian Government was chartered by the Brunei State Government to conduct the survey in mid-April 1968. Another survey was scheduled to take place off Brunei by June 1968. During the 14-day survey in April, local fishermen were taken on board to learn about trawler fishing.

Dr. Birkenmeier, the Brunei State Fisheries Officer, said the survey will be repeated 3 to 4 times a year to determine the feasibility of trawler fishing off Brunei. Development of deep-sea fishing will depend greatly on the present survey's outcome.

All trawling was conducted outside the 3-mile territorial limits to avoid traditional fishing.

Pond Culture

Another program--construction of a fish-farm in the Sungai Jambu area near Brunei Town--is also progressing well. Initially, 23 ponds will be built to produce fish fry for distribution to pond owners in the State. Tilapia, lampam jawa, and gourami species will be used. Experiments to find out the suitability of other species for pond culture will also be undertaken at the Sungai fish farm.

Fisheries Department plans provide for facilities to demonstrate the construction of fish ponds, their maintenance, and the principles of stocking and other aspects of proper fisheries management.

Since Birkenmeier's arrival in Brunei a year ago, fisheries have become active. Birkenmeier, an Austrian, was recruited by the U. N., although Brunei pays his full salary. (U. S. Consulate, Kuching, April 19, 1968.)



South Vietnam

FISHERIES WERE NOT AFFECTED BY TET OFFENSIVE

South Vietnam's Fisheries Directorate surveyed the effects of the recent Viet Cong offensive on marine and freshwater fisheries.

In general, marine fisheries were affected only slightly. Landings remained normal. Only a few privately owned fishing vessels were destroyed.

A market survey on May 22, 1968, reveals fishery retail prices about 15 to 20 percent higher than pre-Tet prices. There has been a continuing decline in retail prices since the peak reached immediately after Tet.

Fish Hatcheries Damaged

Five of the 9 freshwater fish hatcheries were damaged in varying degrees: almost 80 percent for hatcheries at Hue, Banmethuout, Bing Duong, My Tho, and Ving Long; 40-percent damage at Dalat and Thu Duc. Facilities and equipment were destroyed, and adult breeders lost. Resettling refugees on fish hatchery stations is hindering return to normal. Besides the Tet offensive, military offensives will further set back fish-hatchery facilities. This is particularly true at the Thu Duc fish hatchery near Saigon.

During January-April 1968, about 250,000 fingerlings were distributed, compared with 620,000 fingerlings in the 1967 period. Last year's distribution of 1.6 million fingerlings probably will not be reached under present conditions. The number in 1968 may not exceed one million.

It will not be possible to achieve the planned 10-percent increase in production of freshwater fish. Production may decline as much as 10 percent.

The Prospects

The marine fishing industry possibly will approach a 5-8 percent increase in total catch. At best, freshwater fish and pond-reared fish catches probably will reach no more than last year's 54,000 metric tons. The destruction of fish hatcheries will curtail fingerlings distributed. The number of new ponds constructed probably will remain low. Delta flooding, always an unknown factor, has a great influence on the tonnage of freshwater fish caught in any year. (U. S. Embassy, Saigon, May 31, 1968.)



Taiwan

TUNA SALES COMPANY FORMED

The China Marine Trading Co., a government-backed tuna sales firm formed by the Taiwanese tuna industry, was scheduled to start operations on June 18. The company was established with an investment of US\$250,000. It will handle sales of tuna caught by Taiwanese vessels and serve as central supplier of fishing gear and bait. It also plans to operate refrigerated carriers for the fishing fleet. Future plans include establishment and operation of overseas tuna bases in the Indian and Atlantic Oceans. ("Suisan Tsushin," June 1.)

TRANSFER OF TUNA VESSELS FROM AMERICAN SAMOA PLANNED

The Taiwanese tuna fishery operators based in American Samoa plan to transfer their large refrigerated vessels to other oceans because the South Pacific catch is declining. In 1967, their vessels accounted for over 35 percent of the total tuna catches delivered to the Island.

Taiwanese Fleet

The Samoa-based Taiwanese fleet is around 70 vessels, about 40 equipped with refrigeration. The Taiwanese hope to use their large 200-gross-ton vessels in the Indian and Atlantic oceans where there is good seasonal fishing for yellowfin and albacore. They expect no trouble finding suitable bases for their operation. In the Indian Ocean, the Japanese Overseas Fisheries Company operates a large tuna base at Port Louis, Mauritius. In other areas, the Japanese trading firms are actively seeking to contract Taiwanese vessels to fish for them.

Agent for Taiwanese

The China Marine Trading Company also will represent Taiwanese vessels that land fish at Port Louis and at Tema, Ghana. ("Suisan Tsushin," May 24.)



Indian Ocean Tuna Fishery Slackens, Prices Firm

Japanese long-liners have been fishing for yellowfin in the western Indian Ocean off Mombasa, Kenya, since late October 1967. Until the fishery began tapering off recently, good catches averaging 4-5 tons per vessel per day continued for months. Their shipment back to Japan began to weaken prices there. The long-liners moved southward gradually to albacore grounds off Durban, S. Africa.

Off Durban

In the western Indian Ocean, off Durban, the albacore season normally starts in May. It continues good into late June. About 25 Japanese long-liners were fishing there in early May. So were close to 100 Taiwanese (Formosan) vessels. Japanese trading firms were said to be competing with each other to buy catches from the Taiwanese. One firm, reportedly with a refrigerated carrier vessel anchored at Tamotave, Malagasy Republic, was ready to receive the catches.

Port Louis Prices

The Japanese Overseas Fisheries Co., which manages the tuna base at Port Louis, Mauritius Island, announced it would pay the prices shown below for Indian Ocean-caught tuna delivered to Port Louis in May 1968. Excepting the price for large albacore, reduced by US\$12 a short ton, the May prices were the same as April's. ("Katsuo-maguro Tsushin," May 2; "Suisan Tsushin," May 6.)

Species	May 1968
	Ex-Vessel Price US\$/Short Ton
Albacore, round:	
Large--over 24 pounds,	353
Small--under 24 pounds,	257
Yellowfin, gilled & gutted:	
All sizes	302
Fillets--over 26 pounds	290
Big-eyed, gilled & gutted:	
Over 66 pounds	202
Fillets--over 26 pounds	315
Bluefin, gilled & gutted:	
Over 66 pounds	202
Fillets--over 26 pounds	264



AFRICA

South Africa

'NORWEGIAN SEINING' MAKES DEBUT

Experiments in applying Norwegian purse-seining techniques to South African conditions are being carried out by 2 South African companies.

One company, the Oceana Group, decided to charter a Norwegian seiner, complete with skipper and crew, for a South African fishing season. This vessel is operating off the west coast.

The second company, Southern Sea, decided to convert a suitable vessel that became available in Cape Town. The company acquired the "Ali," a 12-year-old, 310-gross-ton, Dutch-built, side trawler with a steel hull in excellent condition.

The Ali's length, 139 ft. 6 in. overall, makes her the biggest purse seiner owned by a South African company. Had she been designed for purse seining, her beam of 23 ft. 7 in. would have been greater. Yet her fish hold, which held 120 tons of white fish in ice in her trawling days, should take 250 or more tons of pilchards with ease.

Norwegian Seiners

The big Norwegian seiners carry a bas-boat, or towing boat, used for two main functions in their fishery. It carries an auxiliary sonar installation. When a sizable shoal has been located by the mother vessel, the bas-boat is launched to obtain at close range information on its depth, direction, and approximate speed.

Meanwhile, the seiner stands off to avoid disturbing the fish. Only when she has received the report from the bas-boat, by walkie-talkie VHF radio, does she move in to trap the fish.

The second function of the towing boat is to pull the bows or stern of the seiner out of the net if the wind tends to push her hull towards it; for this work, she is given a powerful engine.

Most Icelandic seiners, on the other hand, use their towing boat for this second role only. It does the work of a transverse thrust propeller.

Southern Sea's Bas-Boat

Southern Sea has imported an 18-ft. glass-reinforced, plastic bas-boat from Norway. Whether it will be used for one or both of these roles will be decided after experiments on the fishing grounds. The plastic boat is powered by a 95-hp. diesel, equipped with hydraulic steering, and carries its own sonar fish finder. ("The South African Shipping News and Industry Review," Mar. 1968.)



Ivory Coast

PLANS FISH IRRADIATION PROJECT

The Fisheries Department of Ivory Coast, West Africa, plans to initiate a fish-irradiation project. It awaits the arrival in a few months of a "Gamine III" irradiator modified for use with fish, fruits, grains, and vegetables.

French Aid

The project will be financed by France's Fonds d'Aide et de Cooperation (F.A.C.), subject to approval by the Fonds Europeen de Developpement (F.E.D.). The irradiator will be shared by other scientific and developmental institutions in Abidjan. It will focus primarily on the abundant sardinellas (*Sardinella aurita* and *Sardinella eba*) and the "Fritures" (*Otoperce aurita*). Preliminary work on this project was started in 1966 by two EURATOM experts. (Regional Fisheries Attaché, American Embassy, Abidjan, May 17, 1968.)



Senegal

FISHING INDUSTRY IMPORTANT BUT GROWTH SLOW

The fishing industry of Senegal is an important part of the economy--but prospects for significant growth are not good. The industry contributes about 3% of the country's gross domestic product, 10%-12% of its export cannings, and work for about 25,000 people.

The industry is largely "traditional." About 80%-85% of all fish landed are caught by small, canoe-type, fishing boats called "pirogues" that operate close to shore. Thirty-three percent of the pirogues are powered by outboard motors, which may be bought without paying Senegalese customs duties; the remaining 67% use sails.

The boats are manned by 2 to 6 fishermen and equipped with handlines and/or small nets. The bulk of their production is sold fresh in the local markets. There are no refrigerated trucks carrying fresh fish to the interior. There are no cold storage facilities outside Dakar and a few large interior cities.

Most of the statistics in this report are extremely rough estimates by government fishing experts.

Shrimp Fishing

Shrimp fishing in Senegal has been a growing industry and still has much room for development. Fishing experts believe that both sea and river shrimp production can easily be tripled without danger of "overfishing." Production in the 1966/1967 season was estimated at about 1,100 tons, 160 tons more than in 1965/1966. Virtually all present shrimp production is exported to France. The shrimp processing companies, however, have indicated interest in exporting to the U. S.

The shrimp trawlers operating out of Senegal fish mainly for the P. duorarum, found in two distinct zones: one over a large plateau extending north from Cayar, 100 Kms. north of Dakar, to Saint Louis on the Mauritanian border; the other is over a small plateau just south of Cape Roxo on Senegal's southern border with Portuguese Guinea.

Industrial Fishing

The few industrial fishing boats supplying the processing industry are mainly French

owned. In the 1966/67 season, there were 43 French boats. They serve primarily the tuna canning industry.

Senegal has 5 fishing vessels with freezing facilities belonging to the government-owned and operated Société Sénégalaise d'Armement et de Pêche (SOSAP). These boats were acquired from France under a loan agreement. Senegal wants to increase her share of industrial fishing. She ordered 10 tuna boats from the Soviet Union under the 1965 accord. The Soviets agreed then to loan Senegal \$6.7 million for the tuna industry.

Senegal also intends to buy four more boats from France for delivery by 1973. Senegal seeks to establish its own fishing fleet of 40 vessels capable of operating year-round out of Dakar.

Industrial Marketing

Almost all of her processed fish is exported to France. Senegal's tuna exports benefit from a higher-than-world-price under a yearly established quota (11,000 tons in 1966/1967 season). Tuna production has averaged only 8,000 tons in recent years; so Senegal has been able to sell virtually all of it to France at a profit. Otherwise, the tuna industry would have faced very low world prices and had to export at a loss.

Many local observers believe that the large (15,000-20,000 ton capacity) tuna-canning complex the government is considering building with Soviet help would be a financial disaster. They say present canning facilities are operating at less than 50% capacity. In all likelihood, there will be no further action on the tuna complex until 1973. By then, Senegal may have enough boats to guarantee an adequate supply for the proposed cannery.

Main Fish-Processing Establishments

Senegal's 3 tuna canneries, SAPAL, Conserverie du Sénégal, and SCAF, are in the Dakar-Rufisque vicinity. Total production capacity is around 20,000 tons--over twice the average landed catch during the past 3 years.

The supply of fish to the canneries is strictly controlled by a Paris-made agreement. Only the Comptoir Sénégalais des Industries de la Conserve Alimentaire (COSICA) is authorized to buy tuna directly from the fishermen. Then COSICA distributes to each

Senegal (Contd.):

cannery the percentage of the French quota allotted to it. In the last two seasons, a 50% share was given to SAPAL, 30% to Conserveries du Sénégal, and 20% to SCAF. The quota eliminates any supply advantages a cannery might get if it owned its own fleet.

Fish Flour*

There is only one fish flour factory: Afric-Azote, on Dakar's outskirts. The company began in 1964 and has progressively increased production. It was 1,620 metric tons in 1966. A major expansion of plant facilities began in 1967 to raise the plant's present 2.5 ton/hr. capacity to 9 ton/hr.

The breakdown of Afric-Azote's raw materials is: 20% tunafish leftovers from canning plants and 80% sardinella. The fish flour from tuna leftovers contains 60%-63% protein, and from sardinella leftovers 65%-68% protein. However, the company has ordered a machine from Sweden that can raise protein content of tuna leftover flour to 65%-68% and of sardinella flour to 70%-72%.

Afric-Azote exports all its fish flour; 95% goes to France to be used primarily as poultry feed. The 1967 F.O.B. Dakar selling price was 40 CFA/kg. (\$0.16) for sardinella flour, and 38 CFA/kg. (\$0.15) for the tuna flour.

Sardinella

Although 20%-40% of Senegal's total annual fish catch consists of sardinella, there is very little industrial processing of it for human consumption. In 1966, a small firm, the Société Africaine des Industries du Bâtiment (SAIB) undertook to can it. Virtually all its first year's production (130 metric tons) was exported to neighboring countries, which probably will remain its main customers. In Europe, the sardinella would have to compete against sardines, which have fewer bones and higher quality.

Fish Freezing and Storage

The Société des Frigorifiques du Sénégal (SOFRIGAL) in Dakar handles almost all frozen fish business in Senegal. The firm is a joint venture: the Banque Nationale de Développement du Sénégal owns 35%, André Dhellemes et Cie de Roubaix SARL 32.5%, and Star-Kist Tuna Inc. the remaining 32.5%. The plant has a 100 ton/day fish-freezing capacity, a 2,000 ton storage capacity, and an ice-production capacity of 40 tons/day.

According to the official regulations governing the tuna fishing campaign, SOFRIGAL receives all frozen tuna landed in Dakar for reexport later. Since SOFRIGAL is not allowed to send more than 20% of its tuna exports to France in the form of skipjack, it may sell its excess frozen skipjack to the canneries.

*Editor's Note: This is fish meal, not fish flour or fish protein concentrate (FPC).



HOW DID SEAS, SUCH AS THE BLACK, RED, AND WHITE, GET THEIR NAMES?

Because the Black Sea is landlocked, it is deficient in oxygen, except near the surface. The high concentration of hydrogen sulphide causes a reducing environment (opposite of oxidation), resulting in a black color.

Oddly enough, the recurring bloom of small blue-green algae (Trichodesmium erythraeum) imparts the red color to the Red Sea.

The White Sea received its name from the ice that covers it more than 200 days a year.

The color of the Yellow Sea is caused by the yellow mud which is carried by rivers, especially when floods occur. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

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RED TIDE USED IN ANIMAL FEED

Experiments show that red tide, *Gonyaulax polyedra*, a single celled plant pest, is a safe food for laboratory animals. According to a team of California and Pennsylvania researchers, rats thrive as well on red tide as on a diet rich in casein, a high quality milk protein. Powdered red tide has up to 26 percent protein including all the amino acids necessary for nutrition. It could also be used as a protein feed for cows but humans cannot digest it.

Red tide, a type of phytoplankton at the beginning of the aquatic food chain, grows abundantly in the ocean off California and Florida. Some scientists believe that temperature and the oxygen content of ocean water control the rate of its growth. So far they have been able to harvest only small quantities of the abundant tide using fine nets and seines to collect it. (Reprinted with permission from "Science News," weekly summary of current science, copyrighted 1966 by Science Service, Inc.)

Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.



UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES



Fresh Seafoods By Air



Bureau of Commercial Fisheries personnel work with the coastal fishing industry, container manufacturers, airlines, retailers, and wholesalers in developing and expanding markets for fresh domestic fishery products. Particular emphasis is being placed on developing markets for fresh coastal seafoods in the Midwest and the East.

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COMMERCIAL FISHERIES *Review*

VOL 30, NOS. 8-9

AUGUST-SEPTEMBER 1968



COVER: Fisherman of Ceylon. (Photo: FAO/Alan Glanville)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.



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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."

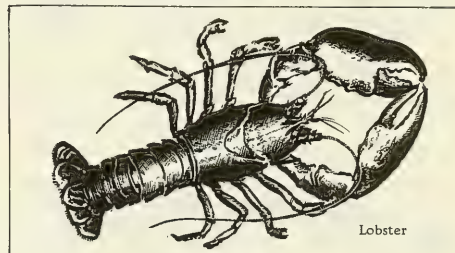
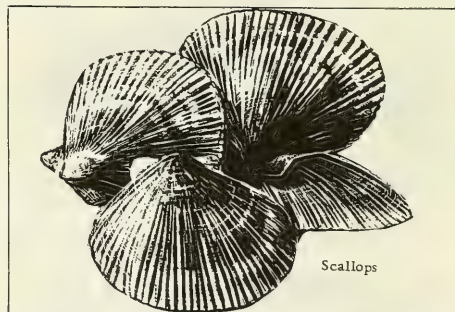
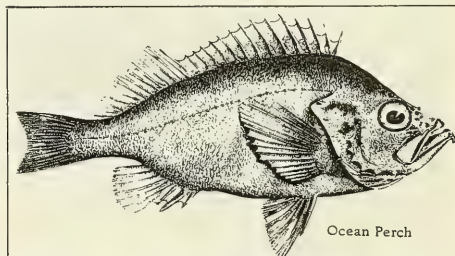
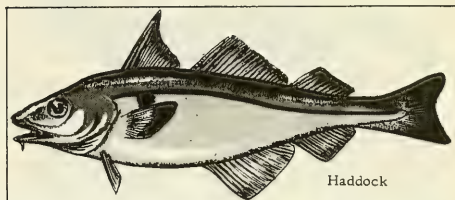
MAJOR CAUSES OF FISHERMAN'S PLIGHT

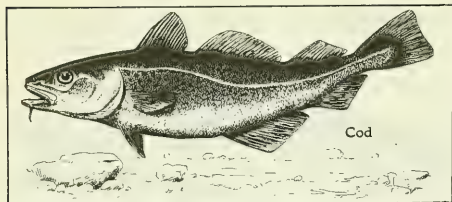
The report sets forth 3 major causes of the fisherman's plight:

- 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."

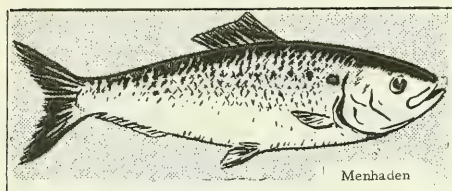
"Most of our well-known natural stocks of fish are near the sustainable limit of production." The list includes in --

New England

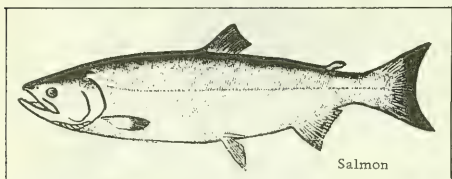
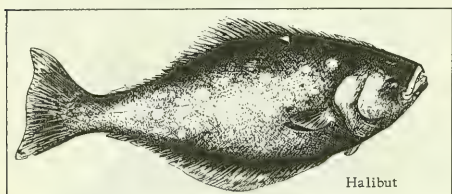




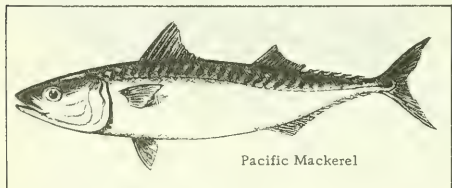
Middle Atlantic



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 - FFC.

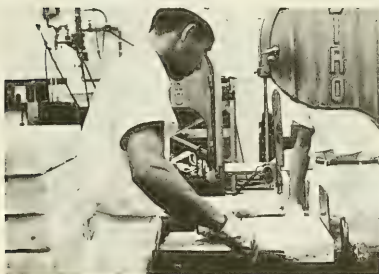


Fig. 3 - Frozen fish blocks.

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-priced species: certain crabs, mollusks, and northern shrimp. By modifying 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 on 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 positive 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, Robert 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, Sigfried Jaeger, and Harold Lokken.



UNITED STATES

Ford Foundation Aids Science of Ecology

The Ford Foundation has granted \$3964,550 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



Vehicle to study ocean's upper layers. Biologist Reginald Gooding in observation chamber of raft "Nenne" 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)

to expand programs in ecology. Five of the 7 new grants are for the same purpose.

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 other nonliving resources of the seabed and soil, 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 miles 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 filets 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 3½ million pounds. Foreign fish-block producers will need to shift more of their production from fish blocks to packaged fish filets 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 4½ 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 nec-

essary 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. ("Feed-stuffs," 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 Veraguas 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 Ikhtologii" (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.



OCEANOGRAPHY

Scientists Hope to Solve Mystery of Deep Scattering Layer

One of the great mysteries of the ocean--deep scattering layers--has turned scientists of the U. S. Naval Oceanographic Office into detectives. These seagoing sleuths recently netted their "evidence," thousands of marine organisms, on a 7-day cruise north of Hawaii. The task is to analyze the evidence in the laboratory hoping that it will shed some light on the 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 similar 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 their 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.



Oceanographers Study History of N. Atlantic Ocean's Floor

Scientists aboard a modern oceanographic ship, the USNS "Kane," are trying to unravel the history of the North Atlantic ocean floor. The operation is part of Project GOFAR of the U. S. Naval Oceanographic Office to seek global understanding of ocean-floor geological processes and their relationship. This understanding could enhance the Navy's operational capability and increase knowledge of the ocean floor and its natural resources.

Mid-Atlantic Ridge

The Kane departed in late June. In early July, she was gathering data on a major underwater fracture zone in the Mid-Atlantic Ridge, created when the ridge crest was displaced laterally.

During the 2-month cruise over the fracture zone, the oceanographers are studying its magnetic signature, echo soundings, seismic reflection and seismic refraction. They are dredging at daily station stops over the underwater cliff formed by the earth's breaking movement. They hope the dredging may enable them to collect rock uncovered by the fracture. "Other station work includes piston coring, sea floor photography, temperature and salinity probes, heat flow investigations, and studies of the amount of sediment being carried in the water near the bottom."

All magnetic and topographic data are being fed into computers aboard the Kane, which are compiling profiles of the ocean floor.

The oceanographers are working up the data as they go and hope to have a good analysis 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 anytime the speed and direction of the current at numerous places in the bay.

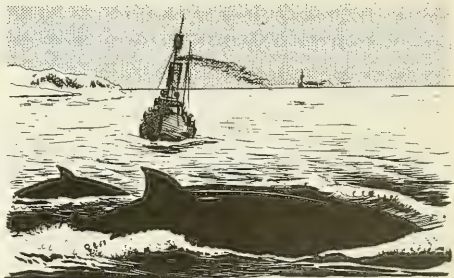
The new charts are useful to commercial shippers, boaters, and fishermen.

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°52'1 N. and 124°02'9' 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-Kamchatskii.

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 later 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 $\frac{3}{4}$ -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

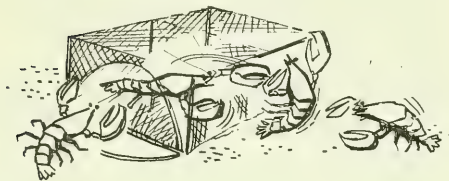
Dr. Ted S. Y. Koo of the University's Chesapeake Biological Laboratory at Solomons, Md., says that a reward of \$1.50 will be given for the return of fish and the tag, and \$1 for the tag alone. It is essential that information on date, place, and method of capture be included. Dr. Koo requests all fishermen 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 silt 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."



Fish Respond More to Speed Changes by Fish on Either Side

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

Fish On Side Greater Stimuli

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



Geographical 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.

Feeding 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



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

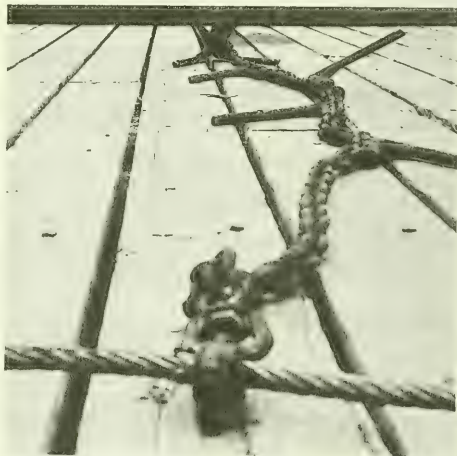
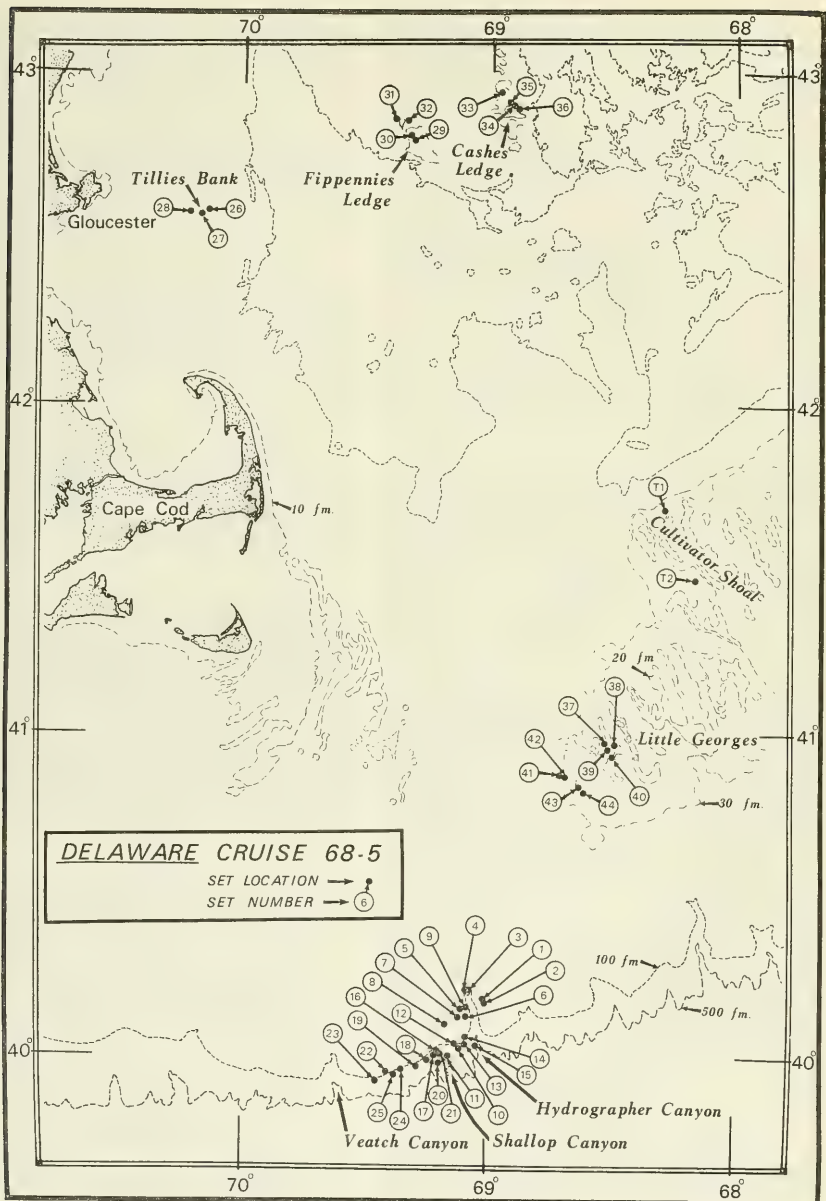


Fig. 2 - Single length of chain on the grapnel "array." The chain snakes over the bottom in close contact with the surface. At least 2 of the single prong hooks, as well as 2 prongs of the terminal 4-prong grapnel, usually maintain bottom contact.

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.



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 $12\frac{1}{2}$ ° Celsius (about 49 to $54\frac{1}{2}$ ° Fahrenheit). Most bottom temperatures ranged from 11 to 12° C. (about $51\frac{3}{4}$ to $53\frac{10}{2}$ ° 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 $39\frac{1}{2}$ ° 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 resource. 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, Fippenies 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 $39\frac{3}{4}$ F.), respectively.

On Cashes Ledge, 2 lobsters were caught by 22 pots set in bottom-water temperature of $4\frac{1}{2}$ C. and 4 lobsters were caught by 22 pots set in $5\frac{1}{2}$ 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 shallow 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 $7\frac{1}{2}$ C. and, near southwest side, it was $10\frac{1}{2}$ 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 in-shore-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 trawl 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 (positive 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

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 Difference
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

material since more pounds of each species were caught with no electrode arrays in net compared to net with arrays.

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 electrofishing 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 $\frac{1}{2}$ -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 height¹ 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 $\frac{1}{2}$ -hour haul. The largest catch (257 scallops) occurred at the 50-fathom station in row 14 off Breakers, Washington. Eight $\frac{1}{2}$ -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 $\frac{1}{2}$ -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:

¹The 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

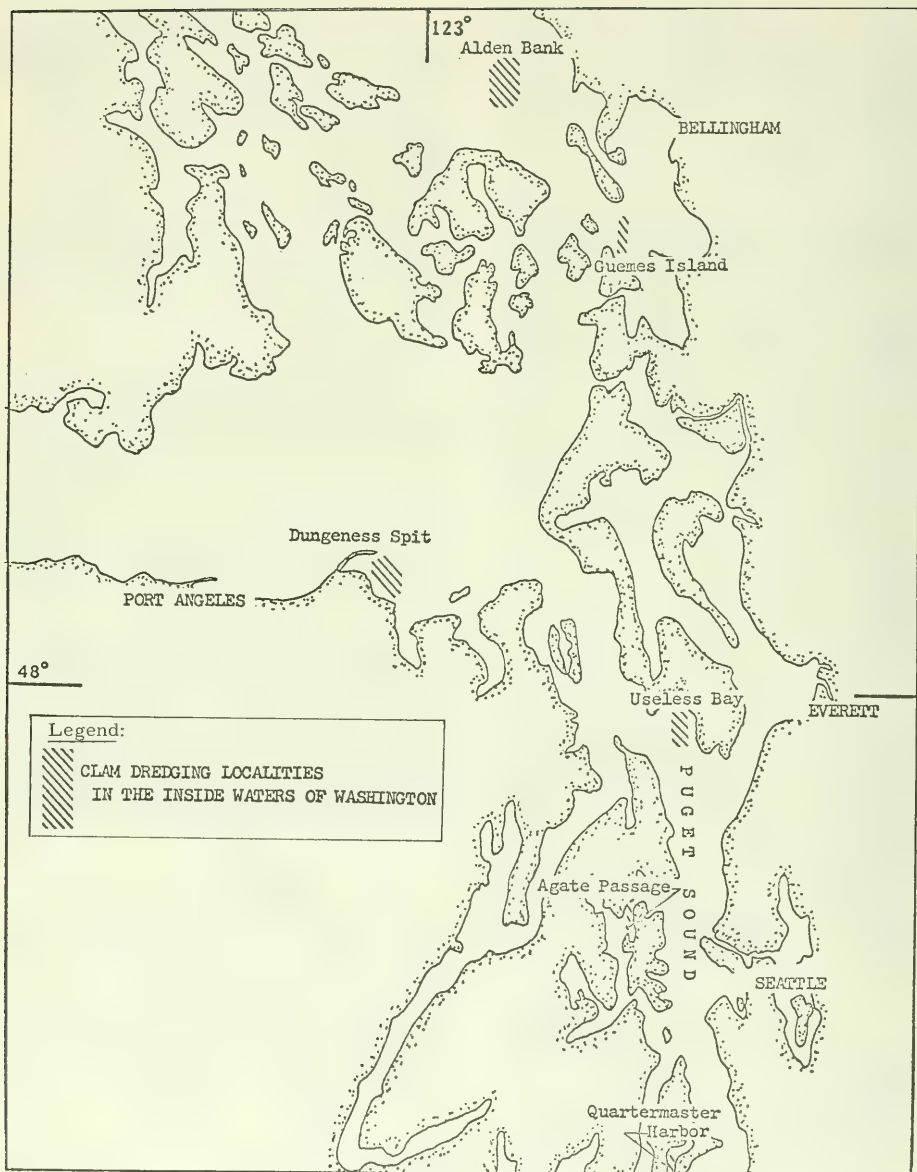
In addition to the work off Washington, a line of stations off Cannon Beach, Oregon, was surveyed. These had been sampled during Cobb surveys in 1963 and 1967. Although they produced the largest catches in 1963, in 1967 scallops were nearly absent at these stations. This year a few small catches of scallops 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 $\frac{1}{2}$ -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.)



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 indi-

cator. 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 2½ 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;

in 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.

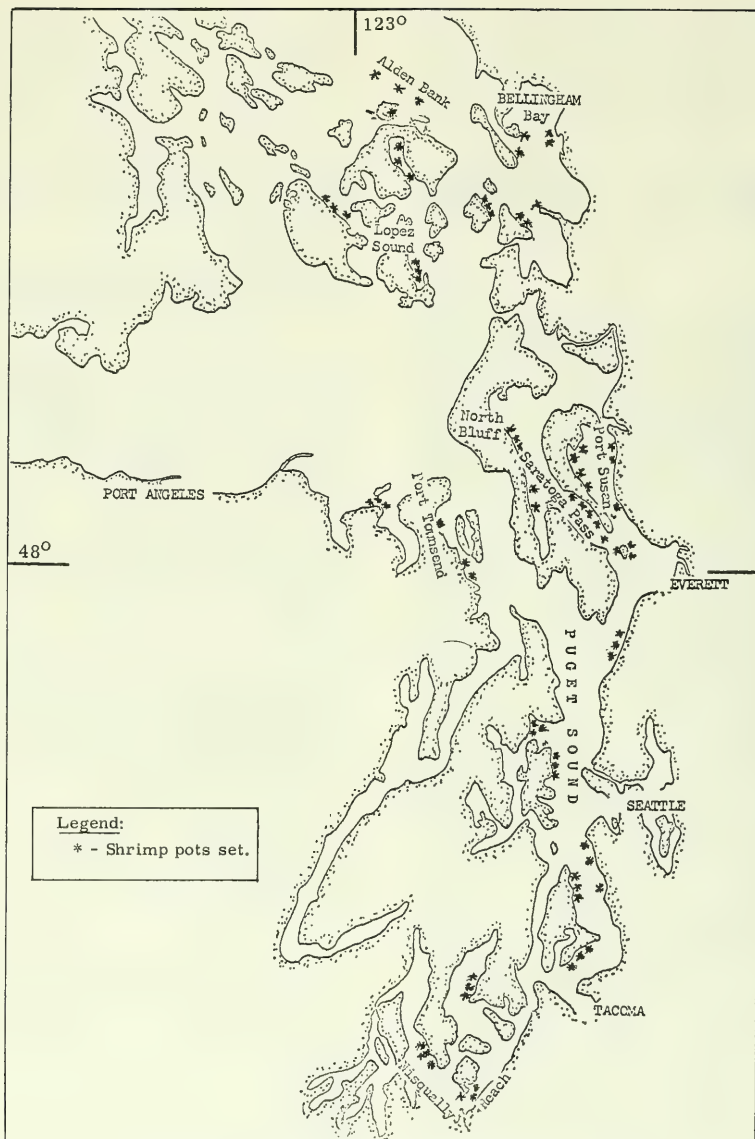
Note: For further information contact: Dayton L. Alverson, Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Boulevard E., Seattle, Wash. 98102, Phone 583-7729.



'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 Nis-

qually 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.

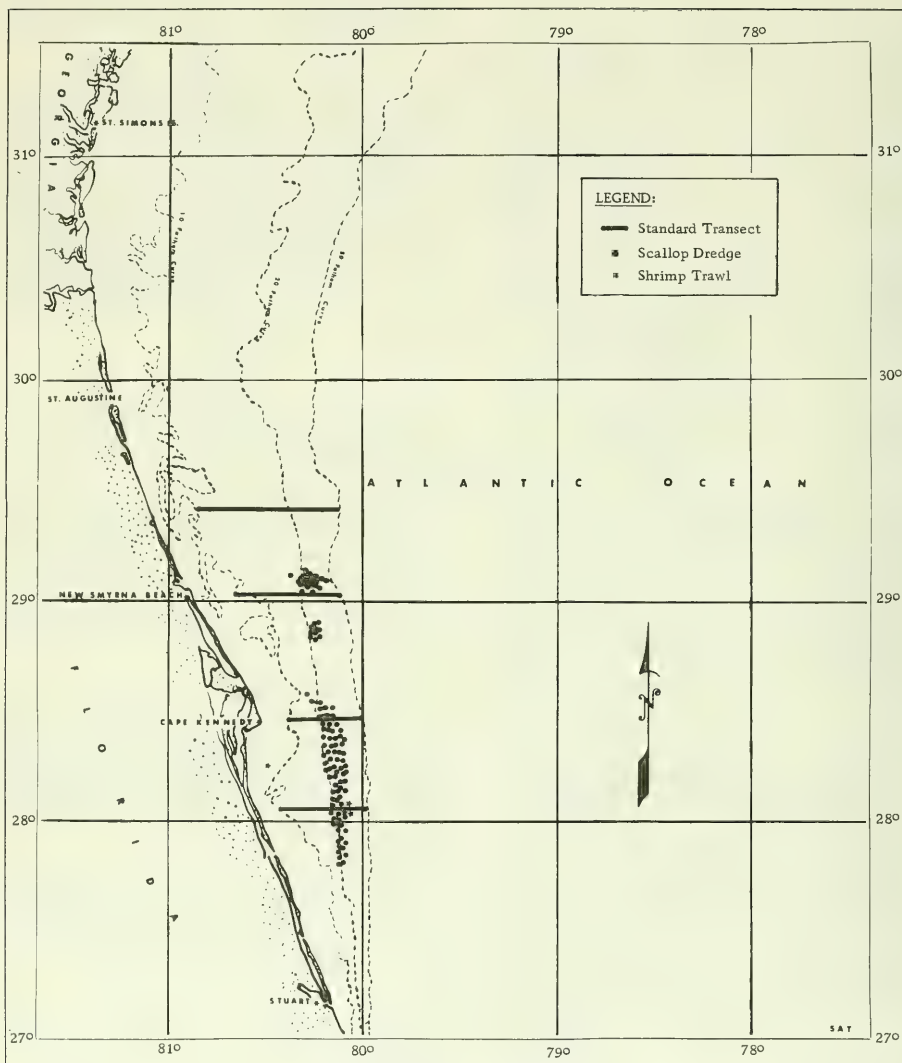
Primary Objective

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 north-east 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 trawlfished 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 4½-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 trawldrags of 4 and 4½ 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°03' 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."

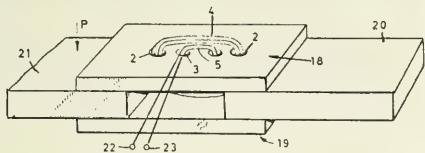
They add: "A few modifications would greatly increase the efficiency of the operation. Specifically, a larger reel and stand, capable of holding all the mainline, would make it possible to work the gear with a minimum of 3 or 4 men."



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 from "Science News," weekly summary of current science, copyrighted 1966 by Science Service, Inc.)

ARTICLES

THE DUNGENESS CRAB FISHERY Around Kodiak, Alaska

By Robert M. Meyer*

Alaska seiners and power barges form the bulk of the fleet that fishes for Dungeness crabs in Kodiak waters from May to October. Crews normally number three men who may set, pull, and reset over ten 30-pot strings a day in shallow, near-shore waters. The pots are baited with herring, clams, or squid. As each pot is pulled, the catch is placed in tanks filled with circulating sea water to insure live delivery to the processing plants. The crabs are usually butchered, cooked, and frozen at the plant and are shipped south for further processing. Some of the better crabs are processed whole.

Dungeness crabs are abundant in the waters surrounding Kodiak Island. The fishery usually is conducted in bays around the island and along the mainland side of Shelikof Strait. But in 1967, fishing was concentrated on the rich grounds off the Trinity Islands just south of Kodiak Island; more than 4 million pounds were harvested there.

In 1966, because of lack of effort, only 300,000 pounds of Dungeness crabs had been taken on the Trinity Islands grounds; in 1965, 2 million pounds were harvested.

Weather Controls Fishery

The fishery around Kodiak Island is controlled by weather, rather than by regulations, because it is carried out in shallow water--5 to 20 fathoms. Fishermen must wait for the passing of the winter storms before they set their crab pots; otherwise, the storms would sweep the pots away or bury them in the sand. A few fishermen begin prospecting for crabs about the first of May and, by month's end, fishing is generally in full swing. The peak is reached in July. In some areas, it may continue until September or October, when fall storms force the boats to leave the fishing grounds.

VESSELS AND GEAR USED

Two types of vessels are used in the Dungeness crab fishery around Kodiak Island--Alaska salmon seiners (fig. 1) and power barges.

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Fig. 1 - Alaska salmon seiner converted to fish for Dungeness crabs around Kodiak Island.

The seiners carry 3-man crews. The holds are fitted with tanks through which sea water is circulated to keep crabs alive until they reach the processor (fig. 2).

The power barges also carry 3-man crews and are fitted with sea-water tanks. Currently, they are the most popular vessels for fishing crabs in western Alaska waters because they can hold more crabs, accommodate more gear, and fish in more adverse conditions than the smaller seiners. The barges are about 87 feet long; their barge size makes it profitable to run the 24 or even 36 hours to the distant crab grounds of Chirikof Island

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Fig. 2 - Dungeness crabs in tank filled with circulating sea water.

and Chignik Bay. In 5 trips in June 1967, for example, one barge brought over 300,000 pounds of crabs into Kodiak. This was a greater catch than the combined catch of all other Dungeness crab boats fishing in the area during June.

The principal gear in the Dungeness crab fishery is a round pot. The pots are 42, 48, or 60 inches in diameter. They are constructed of $\frac{3}{4}$ -inch round steel stock with 2 pieces of $1\frac{1}{2}$ -inch stock welded to the bottom for ballast (fig. 3). The pot frame is wrapped with rubber strips cut from inner tubes. Then it is covered with stainless steel wire woven in a 4-inch stretch mesh. The rubber insulator between the stainless steel mesh and the iron of the pot frame prevents disintegration by electrolysis. Each pot contains a 4-inch escape ring, and two 8- by 4-inch oval tunnels with triggers that close the tunnels so the large crabs cannot escape. A small ring, generally welded to one pot frame member near the top of the pot, allows sublegal size crabs to escape. The crabs are removed and the bait cans changed through a door on the top of the pot. This door is made of a



Fig. 3 - Dungeness crab pots (40 inches in diameter) stacked on deck of power barge.



Fig. 4 - Dungeness crabs in box of razor clams. The clams are used as bait in the crab pots.

stainless steel rod one-fourth to three-eighths of an inch in diameter. The door is hinged at each end and locked in the closed position with rubber straps and hooks.

The pots are baited with razor clams (fig. 4), squid, or herring that are kept frozen on board the boat and thawed just before use. Razor clams are crushed before being put into the bait can; American squid are used whole; the larger Japanese squid are cut into five or 10 pieces; and herring are cut into pieces 1 or 2 inches long. The bait is held in stainless steel louvered bait cans (fig. 5) 7 inches in diameter and 4 inches deep. They have hinged tops and are attached inside each pot with stainless steel hooks and rubber straps.

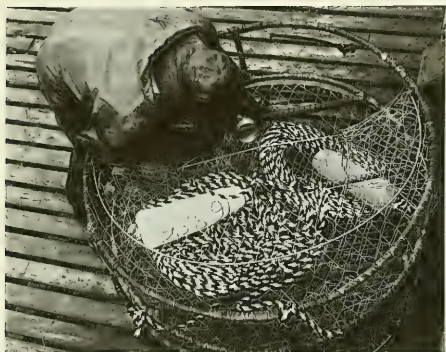


Fig. 5 - Crewman attaching bait can in Dungeness crab pot (60 inches in diameter).

Each pot has a polypropylene or similar line with a plastic foam buoy attached (fig. 5). The line is 10 to 20 fathoms long, depending on the depth to be fished. The buoy is 18 inches long by 4 inches in diameter and tapered at the bottom end to reduce chances of fouling by kelp. The buoys and lines must both be dipped periodically in a chlorine solution to remove fouling organisms, primarily algae and hydrozoans.

METHOD OF FISHING

Just before the fishing gear is set, the skipper selects a course and sets the vessel's autopilot. It is important that the boat be maintained on a straight course to facilitate the recovery of pots in rough or foggy weather. As the setting of gear begins, the buoy line and buoy of the first pot and a colored float used to mark the end of the string of pots are trailed behind the boat. At word from the skipper, the first pot is pushed overboard. The next pot and its line and buoy are carried to the rail. The process is repeated until the last pot of the string, also marked with a colored float, is set. A string may contain 30 to 60 pots. Each boat fishes several strings. These usually are set parallel to each other, and approximately parallel to the beach in 5 to 20 fathoms.

An efficient crew can lift and reset over 300 pots in a 10-hour day. In good weather, 2 deck hands can pick and reset more than 60 pots in an hour. To attain this rate, an assembly-line approach must be used in handling the gear. The boat is brought along-



Fig. 6 - Crab pot buoy and line being hooked by crewman in preparation for hauling pot aboard. Plastic garbage can shown holds chlorine solution in which buoy and line are dipped to remove fouling organisms.

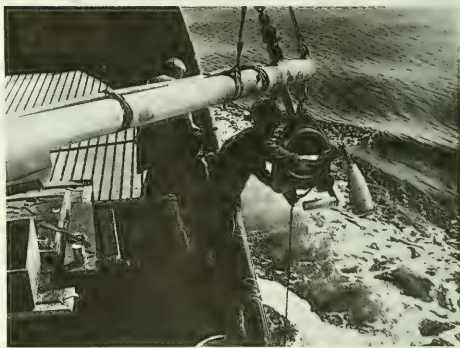


Fig. 7 - Crewman placing line attached to crab pot on the power block so pot can be hauled aboard.

side the buoy to be retrieved. The line is brought on board with a boat hook (fig. 6). It is put in a hydraulic power block mounted on the end of a boom (fig. 7). The boom is lowered so the line can be set in the block, and then is raised so the pot can be swung aboard the boat (fig. 8, facing p. 1) and emptied into the sorting box (fig. 9). One man hauls the pot by keeping a strain on the line, while the other man fills a bait can and sorts the previous catch. After the pot is aboard, the catch

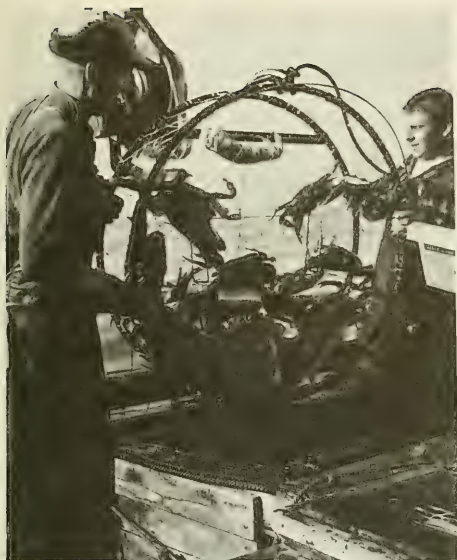


Fig. 9 - Crewman emptying crab pot (40 inches in diameter) into sorting box.

is removed and the bait can be exchanged. Dungeness crabs are put into the sea-water tank, and fish, octopus, and king crab are thrown overboard. The pot is pushed overboard about 75 feet before the next buoy is reached. The boat does not stop at each pot; the men must haul the pots while the boat is underway at a continuous speed of about 2 knots (fig. 10). Because the boats usually work into the wind, they must, upon reaching the end of a string, run to the opposite end of

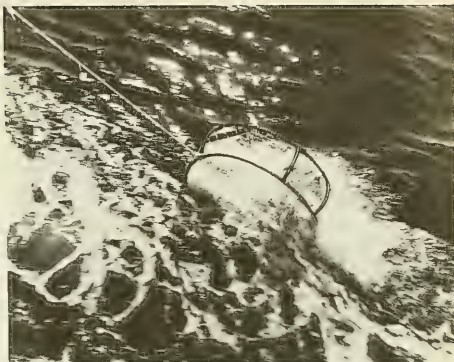


Fig. 10 - Crab pot (40 inches in diameter) surfacing to be hauled aboard power barge. Vessel is traveling at about 2 knots.

the next string. This break gives the crew a chance to clean up and rest before starting the next string of pots.

PROCESSING METHODS

Crabs are processed in one of two ways. The first and most common method is to butcher and clean the live crab and cook the remaining body and leg sections in boiling water for 12 to 15 minutes. The sections are then frozen, glazed, packed, and shipped south, where they are thawed and the meat removed for canning.

At some processing plants, the largest and best-appearing crabs are prepared for the whole-crab market. They are cooked whole for 25 to 28 minutes, cooled, the shells cleaned by hand, packaged one to a paper bag, and shipped south.



THE VIEW FROM A STORIED SUB

The 'Alvin' Off Norfolk, Va.

By R. L. Edwards* and K. O. Emery**

On July 17 and 18, 1967, the authors made 2 dives in DSRV "Alvin," the research submarine of the Woods Hole Oceanographic Institution. The dives were made from the support vessel "Lulu" off Norfolk, Virginia, in 20 to 25 fathoms. During each dive, which lasted nearly 7 hours, we observed closely a series of underwater ridges and their fauna. These were the first dives for both of us and we were not disappointed.

Alvin is a deep-diving research vessel designed specifically for oceanographic research. The funds for construction and operation were provided by the Office of Naval Research. The Bureau of Ships of the U. S. Navy assisted in preparing performance specifications. The Applied Sciences Division of Litton Industries designed and built the sub.

Shape of the Sub

At the surface, Alvin draws 7 feet. It is 23 feet long, has an 8-foot beam, and displaces 15 tons. Submerged, it has a range of 5 miles and cruises at a little more than 1 knot, with a top speed of about 1.5 knots. Its design operating depth is 6,000 feet, where it has a safety factor of more than two. The crew, a pilot and 2 observers, has 4 viewing ports to look through--to see ahead, on either side, and directly beneath the vehicle. The passenger sphere is 7 feet in diameter. It is made of high-strength, 1.33-inch-thick steel. The life-support systems provide for an endurance of 24 hours or more.

Alvin is not large inside. After several hours with a pilot and 2 observers aboard, things begin to feel a bit cramped. The discomforts are minor, however, compared with all the interesting things to be observed outside. And, to help the observers work, the sub is equipped with a tape recorder, television camera, and 2 automatic 35-mm. cameras. Also, each observer can carry a hand-

held camera loaded either with color or black-and-white film. The outside cameras produce stereographic pairs and are actuated by a button--or can be set to operate automatically at a desired interval. A box lunch and coffee are provided if the dive is to last long enough.

A Storied Sub

The sub already has made quite a name for itself. During February to April 1966, it made 34 dives off Palomares, Spain, in the search for a lost hydrogen bomb. Alvin found it in 2,800 feet of water on 2 occasions and played a vital role in its recovery.



Fig. 1 - DSRV Alvin.

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 Note: Contribution No. 2142, Woods Hole Oceanographic Institution, }

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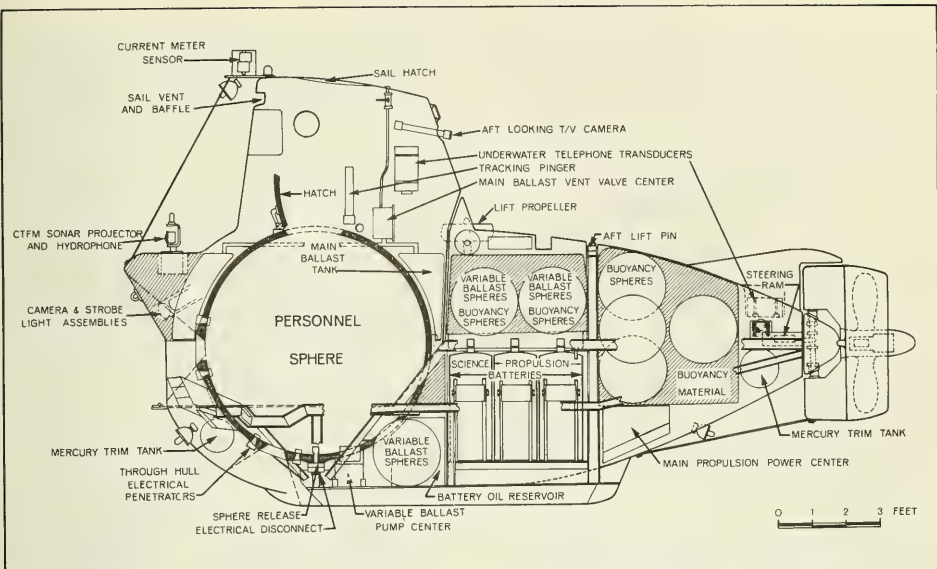


Fig. 2 - Schematic cross-section of DSRV Alvin.



Fig. 3 - Alvin's mothership, Lulu, is a catamaran. Alvin is launched and retrieved from a cable suspended between the hulls. In this picture, Alvin has been raised to working deck.

Just before our dives, the sub further distinguished itself: it blunted the attack of a swordfish in 2,000 feet of water. The swordfish succeeded only in destroying itself. It gave the observers a few bad moments--but later provided a good meal for others. Damage to the sub was negligible. After all, it was designed to withstand this sort of undesired attention.

A Catamaran Named Lulu

In a great many respects, a 96-foot-long catamaran named "Lulu" (DSRVT-1) is as interesting as Alvin. Lulu is equipped with shop facilities to service Alvin. The sub is launched and retrieved by a hydraulic elevator that lowers and raises it between the water and Lulu's maindeck. Launching and retrieving are monitored by skin divers who follow the sub as long as it is at the surface. Alvin is equipped with a sonar transponder so Lulu can constantly monitor the sub's position. Voice communication is also maintained between the two.

Lulu's living quarters are in its starboard hull. It has a speed of about 6 knots and is very comfortable in any but the roughest seas. Launching is not attempted when the wind exceeds force 3, or the waves are higher, or might become higher, than 5 feet.

Why We Dived

The prime purpose of the dives off Norfolk was to investigate the nature of submarine ridges believed to be remnants of old beaches and oyster reefs formed 8,000 to 10,000 years ago, when the shoreline was far out on the continental shelf. We also wished to observe the distribution of bottom organisms and bottom sediments.

Visibility at the bottom was excellent. It exceeded 50 feet at all times. Bright objects, such as the large, clean, white shells of the surf clam could be seen much farther away, but only as diffuse objects. Visibility was restricted principally by the very large numbers of arrowworms (chaetognaths) near the bottom. Artificial light was not necessary at any time, except to determine the true color of objects. The bluish color of sunlight at these depths, plus the general aspect of the bottom and its fauna, strongly reminded one of Salvador Dali's early impressionistic paintings.

What We Saw

The ridges were found with oyster shells, as expected. They extended north-south, approximately parallel with the edge of the continental shelf. Ranging up to about 30 feet



Fig. 4 - An ocean quahog graveyard. These are dead shells. It is possible they may overlie a dense bed of living animals.

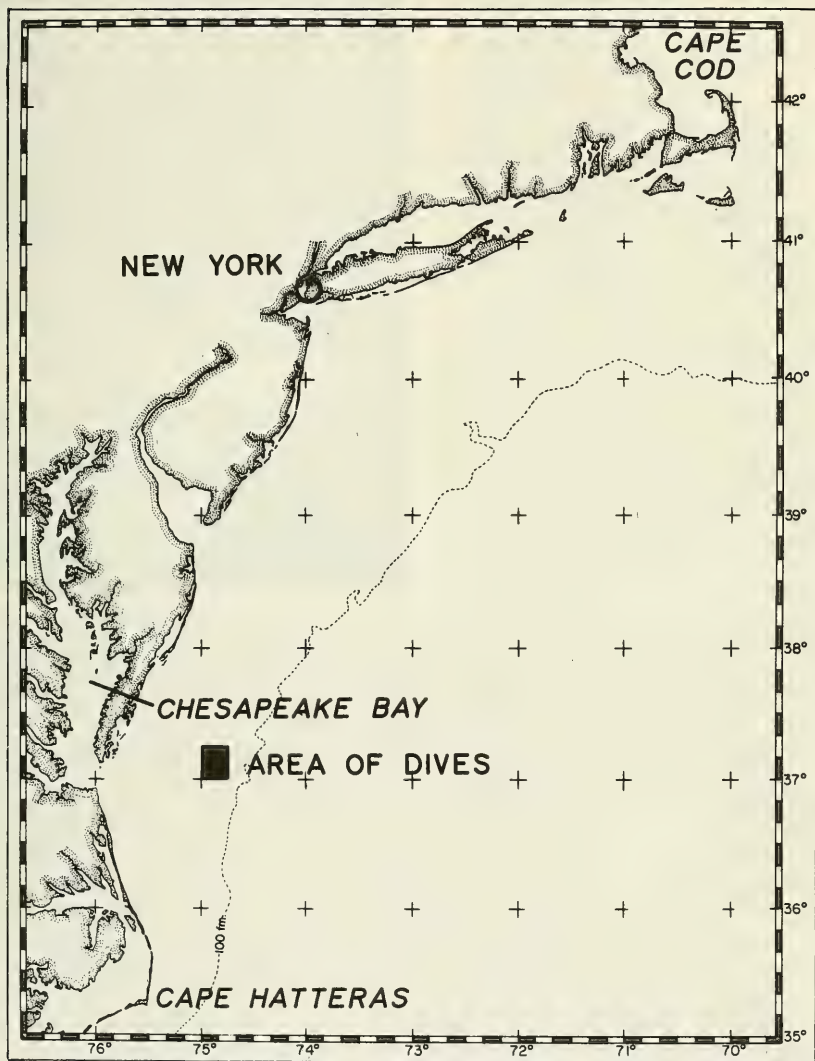


Fig. 5 - Index map showing general location of Alvin dives 205 and 206 made July 17 and 18 on the continental shelf.

above the otherwise nearly flat shelf, they consist mostly of loose coarse sand. Probably they are the submerged remnants of former barrier islands similar to the barrier islands that now outline Cape Hatteras. The flat areas between the ridges are probably the sites of former low marshes that, after submergence, were covered with sand washed from the ridges. Large ripple marks (about 1 foot high and 10 feet from crest to crest) covered much of the tops of the ridges, but they were rare in the intervening low flat areas. These ripple marks, and some smaller ones, are probably formed by seasonal storms. They had been inactive for a long time, probably many months, because their shapes were blurred by the activities of bottom-living animals.

Bottom Communities Biggest Surprise

Our biggest surprise came from the nature of bottom communities. These were many, varied, and distributed in a patchwork-quilt manner. The bottom generally was coarse, grayish-brown, sand. The sand was iron stained, indicating great age. For reasons we did not understand, bottom communities changed radically without an accompanying observable change in the bottom sediment. One area of sandy mud was observed, made obvious only by radical changes in the animal communities. More than 1,000 photographs were taken in at least 10 distinctive bottom communities.

The 2 dives were separated by about 5 miles. Although no significant change in bottom type was noted between the 2 areas, differences in fauna were numerous. For example, the spotted hake was the dominant species seen on the first dive, but only red hake were seen on the second. Many mating cancer crabs were seen during the first dive, none during the second. In the first area, sea scallops were abundant in their shallow holes; although many sea scallops were also seen in the second area, few had dug holes.

Some of the more interesting biological observations, by species, follow.

Red and Spotted Hake

As expected from previous research with the underwater camera, red hake (*Urophycis chuss*) were almost always closely associated with other objects on the bottom. They were seen frequently with sea scallops, both



Fig. 6 - A spotted hake in lower part of picture is cuddled around the shell of a surf clam. Both spotted hake and red hake were seen in such an association. At the top, a large sea scallop is sitting in a typical crater-like hole it made.

alive and dead (shells). The larger fish tended to stay close to objects, the smaller to get in or under such things as shells, sponges, or litter.

To stabilize the Alvin, it was made sufficiently heavy to touch gently on the bottom as it was being driven into the current. As a result, the immediate surface of the bottom was smoothed as the sub moved along. Several times hake were observed swimming quickly to this smoothed area, searching actively with their long pelvic fins for food, heading downstream with the current. When something edible was detected, the fish quickly turned into the current, and then apparently located the object visually and ate it.

The spotted hake (*U. regius*) behaved in much the same manner but seemed to associate less with other objects on the bottom. One even swam into the cow-catcher like

collecting bin on the front of Alvin and stayed there for more than an hour. Most fish paid little attention to the sub until it came within about 2 feet. Then they tended to move away without any panic or haste.

Silver Hake

Echo-sounder traces usually attributed to silver hake (*Merluccius bilinearis*) were abundant in midwater before the second dive. When we submerged at 11 a.m., these traces were nearing the bottom. When the sub reached the bottom, small groups of silver hake were seen moving along slowly, mostly within 1 fathom or so of the bottom. Within an hour, at about noon, no fish were observed off the bottom. Single fish only were seen, resting quietly in shallow depressions. They remained that way throughout the dive, which ended at 6 p.m.

There is nothing silver about silver hake in their natural environment. They looked very much like blotched tomcod. Their general color was brownish, with 5 to 7 irregular, darker, vertical bars. All the fins, but especially the 2 dorsal fins, had a luminescent greenish border. When disturbed by the sub, they swam away slowly to another

shallow depression and settled down again. The only feeding observed took place at the time of descent, when a few fish appeared to be biting at objects on the bottom. This action was associated occasionally with a quick twist, when the fish "flashed" brightly.

Cancer Crabs

Large cancer crabs (*Cancer irroratus*) were common. They appeared to have a carapace width of 6 to 8 inches. One occurred about every 30 to 50 feet of travel. Of all the animals seen, the cancer crabs reacted most strongly to the sub's presence. Most of those not buried began to move away when the sub got within 15 or 20 feet. And, once moving, they tended to continue moving away beyond the limits of visibility. Others, for a time, faced the sub with claws raised and spread in a fighting stance. During the first dive, most of the larger crabs, obviously females, were carrying smaller males.

Fourspot Flounder

Fourspot flounders (*Paralichthys oblongus*) were numerous--one about every 100 feet or so of travel. Two size groups were apparent, the smaller averaging 3 to 5 inches long, the



Fig. 7 - Small silver hake resting on the bottom. About noon these fish were seen in midwater; shortly afterward, they settled to the bottom, where they remained in small depressions for the rest of the day.

larger about 10 to 12 inches. They were resting quietly in the bottom, but they were not covered or buried. No buried flounders were seen. A very large number of much smaller flounders, about 1 inch long, also were seen. These small fish occurred every 3 feet or so, and appeared to be fluke (*Paralichthys dentatus*), not fourspot flounders.

Sea Scallop

Small sea scallops (*Placopecten magellanicus*), most much less than 1 inch in diameter, were very abundant. Often disturbed by the sub, fish, and crabs, they were seen flitting constantly through the water, usually only a foot or so above the bottom. They moved 3 to 6 feet when disturbed and reminded us very much of small tired butterflies.

In addition to these small scallops, 2 other size groups were apparent. Large scallops, 7 to 10 inches in diameter, appeared at regular and frequent intervals. Medium-sized individuals, about 4 inches in diameter, were infrequent. None of the large scallops showed any tendency to "fly," but the medium-sized individuals were as mobile as the small ones and took off at the slightest provocation.



Fig. 8 - Lobster sharing a hole made in the sand by a sea scallop. The hole is about 15 inches in diameter and 5 inches deep.

Large Sea Scallops

In the first area, very large sea scallops occurred every 20 feet or so. Several were closely observed and judged to be between 10 and 13 years of age. Every large scallop occupied a shallow hold about twice its own diameter. The holes did not have elevated rims and were more than deep enough to completely contain the inhabitant. Scallops were seen turning around in their holds, blowing detritus and fine material out. Even large scallops couldn't "puff" hard enough to blow heavier objects out of their holes, however, and thus many holes were lined with larger shell fragments. In some areas, the sea scallops had clean shells; in others, their shells were incrusting with sponges and other organisms. We noticed that the incrusting organisms were not limited to living scallops, but occurred as well on empty shells and other detritus in the same area.

Surf Clams

Surf clams (*Spisula solidissima*) were abundant, judging from the very large numbers of shells we saw. There was no visible evidence of this species living within the sediments. One large specimen (about 6 inches wide) was seen "leaping" across the bottom. It had obviously been disturbed by something and was beating a hasty retreat. The clam rapidly extended its foot in such a manner that it thrust itself upward about 18 inches off the bottom and fell to the bottom 2 or 3 feet away from its starting point. At its maximum extension, the foot was about $1\frac{1}{2}$ times as long as the shell. The foot was retracted much more slowly than it was extended.

And the "Sea Monster"

We had one encounter with a strange organism that we dubbed the "Sea Monster." Near the bottom, during the first descent, Alvin pilot Marvin McCamis called our attention to an object about 25 feet long and 6 inches in diameter. It was undulating slowly in midwater. He secured our sea monster with the sub's mechanical hand and brought it close to the port. It was a chain of unusually large salps. The individual salps were about 5 inches long, paired, and aggregated into a long chain of pairs. We dragged the chain along with us for more than an hour without apparent damage to it. We released it when we needed the claw to pick up some rocks.



Fig. 9 - "Sea monster" and jellyfish. The sea monster is a giant salp common in these waters but seldom seen in chains this long.

Fortunately, we had sufficiently good photographs to identify the organism as Salpa vagina, a species common in these latitudes.

Sub's Value in Research

What use does a sub have in fishery research? No one expected that we would have even half the visibility we enjoyed on these dives. Sometimes we observed the behavior of fishes from considerable distances. It was apparent that all species paid little if any attention to the sub until it got very close. It is reasonable to suppose that worthwhile observations could be made on most or all groundfish species. Some possibilities include a study of haddock spawning behavior, territorialism of redfish, and the diurnal vertical migrations of hake.

One couldn't miss the "butterflies." Sea scallops up to 3 or 4 inches are extraordinarily mobile and, even under conditions of limited visibility, they could easily be seen. A sub would make the ecologic study of the sea scallop a comparatively easy matter, and sur-

veys of sea scallop concentrations for the commercial fleet would be practical and feasible.

Over the years, all biologists who have studied the early life history of the haddock have noted that small haddock tend to be more abundant in those areas where the jellyfish Cyanea also was abundant. On our dives, Cyanea was seen frequently near the bottom. Small fish, apparently all gadids, were associated with some of them. Direct observations on the relationship between haddock and Cyanea could readily be studied from a sub.

Track of the Otter Trawl

Several times during our 2 dives, we observed what must have been the "tracks" of otter trawls and scallop dredges on the bottom. Studies of the direct effects of trawls and dredges on the bottom could be carried out with comparative ease in a sub. Until much faster vehicles are available, however, there is little justification for using one to observe the action of trawl gear directly. Even with maximum visibility, relatively great speed and maneuverability would be required to keep up with such gear--and to avoid the real possibility of accidental entanglement.

Just as the present generation of submersibles has only limited value for direct observation of moving trawl gear, so operations also would be difficult in strong currents, especially along some parts of the New England coast.

Alvin was made sufficiently "heavy" on our dives to minimize the effect of the currents (up to a half knot) by just setting it on the bottom. Control was excellent so long as we were heading upcurrent. During maneuvers, such as turning around to get a second look at some object, the current could be troublesome. Control of these vehicles requires a trained and delicate touch.



THE LATE-SUMMER WATERS OF THE GULF OF MEXICO

By Reed S. Armstrong* and John R. Grady*

After being chased by two hurricanes, "Beulah" and "Fern", BCF's R/V "Geronimo" returned to its home port of Galveston, Texas, on Oct. 8, 1967. It had finished what probably was the most comprehensive hydrographic survey of a sea ever made.

Cruise 16, which began August 14, was the second in a series of hydrographic surveys of the Gulf of Mexico. Each cruise is designed

to cover all waters of the Gulf with the goals of describing the sea and determining how the waters and currents change in time.

We occupied 151 hydrographic stations (fig. 1) using Nansen bottles with reversing thermometers at standard depths. A total of 298 bathythermograph casts was made; samples of surface water for salinity determinations were drawn at each lowering. Salinity and

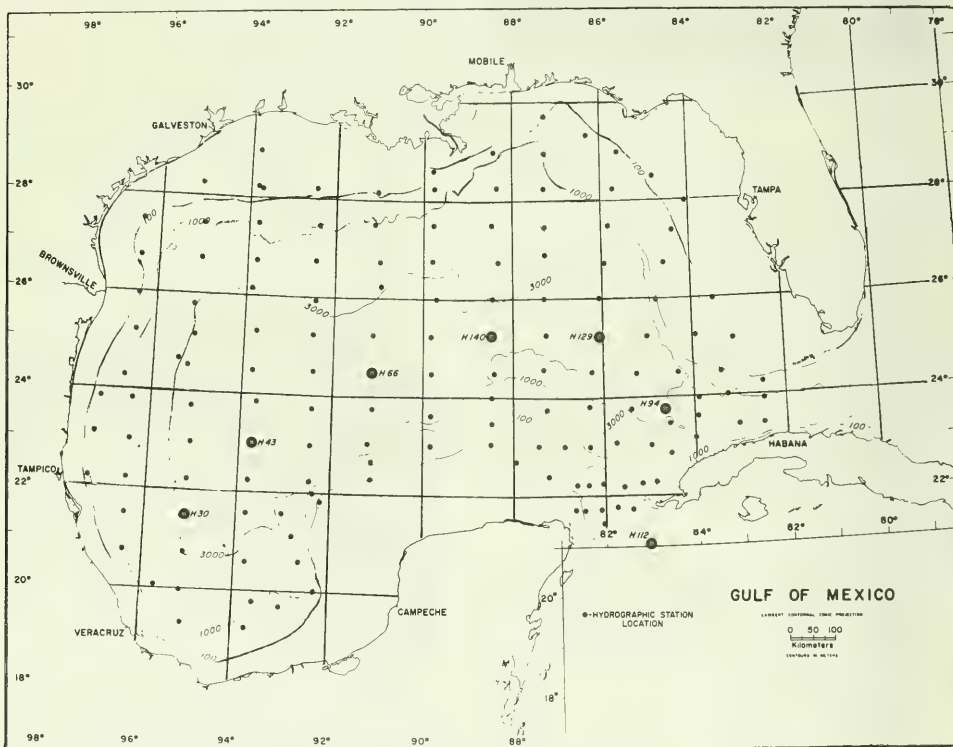


Fig. 1 - Cruise plan for cruise 16, "All Gulf II," of R/V Geronimo, Aug. 14-Oct. 8, 1967. Numbered stations (heavy dots) are used in figures 2-4.

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Note: Contribution No. 258, BCF Biological Laboratory, Galveston, Texas 77550.

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Fish and Wildlife Service
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dissolved oxygen analyses were made at sea. Additional water samples were frozen aboard ship and returned to the laboratory for chemical analyses of phosphates and silicates.

When weather and sea conditions permitted, vertical plankton hauls were made at the hydrographic stations; 119 zooplankton samples were collected to a maximum depth of 500 m.; 141 phytoplankton hauls were made to a depth of 30 m.

Although the cruise data still are being processed, measurements from 7 stations have been analyzed to depict some major features of the Gulf waters (see fig. 1 for station locations). These stations were selected to describe the structure of the water in the northwestern Caribbean before it enters the Gulf, and then to trace the water as it flows through the Yucatan Straits and spreads through the Gulf. The arc connecting these 7

stations generally represents a line along which the waters spread through the Gulf. The data are presented as vertical profiles of salinity, temperature, and dissolved oxygen for each station.

Six water masses in the Gulf are discernible in the vertical profiles of salinity (fig. 2). Dashed lines connect the cores of the separate water masses. The water masses present in the Gulf of Mexico are:

- Caribbean Surface Water (CSW)--This warm water forms in the Caribbean Sea and moves into the Gulf at the surface. It is characteristically water of relatively low salinity--36.0 to 36.2 parts per thousand (p.p.t.)--and is quickly lost by mixing with the western Gulf surface water (occurs only at stations 112, 94, and 129).
- Western Gulf Surface Water (WGSW)--High evaporation rates in the western Gulf pro-

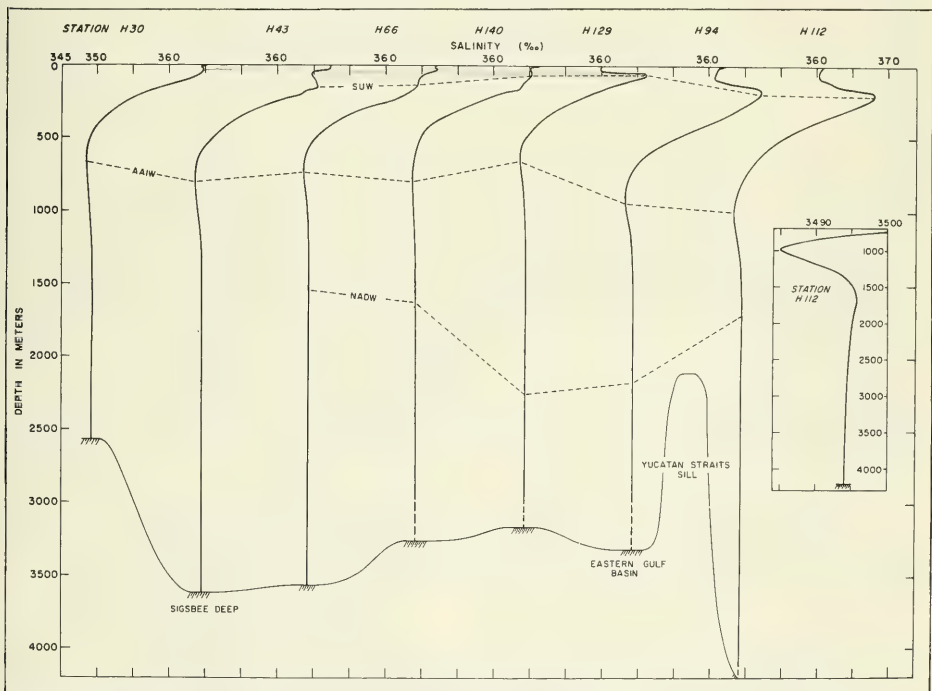


Fig. 2 - Vertical profiles of salinity in the Gulf of Mexico (see fig. 1 for station locations). Dashed lines connect the cores of the water masses. Insert of station H112 depicts characteristic features of deep water masses.

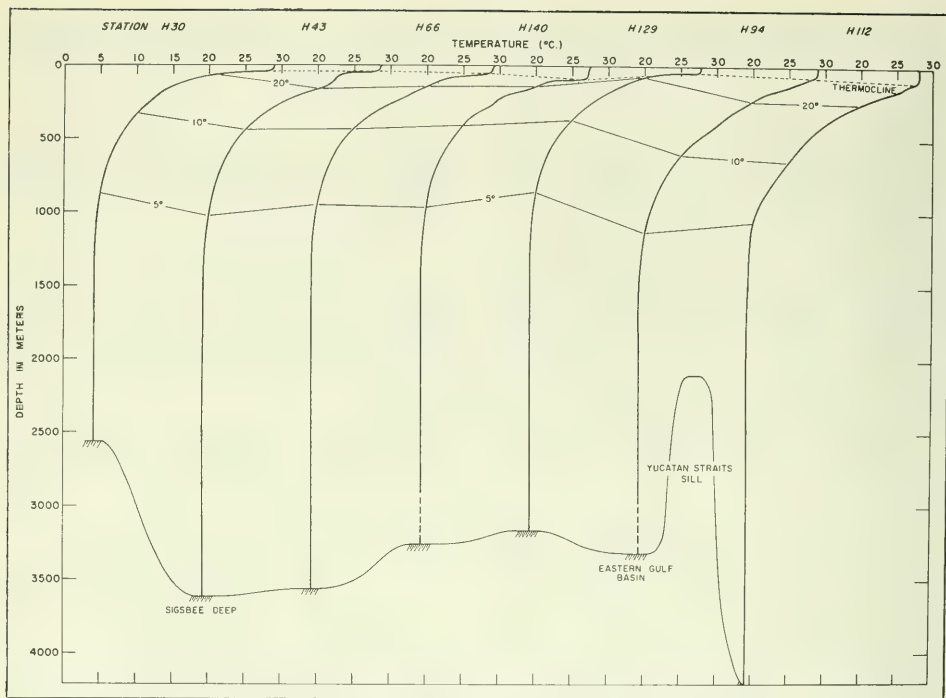


Fig. 3 - Vertical profiles of temperature with selected isotherms in the Gulf of Mexico (see fig. 1 for station locations).

duce a warm, high-salinity (36.5 p.p.t.) water. It is confined to the surface layer in the central and western portions of the Gulf (stations 140, 66, 43, and 30).

- Subtropical Underwater (SUW)--The core of the SUW is defined by the salinity maximum layer. None of this water is present at station 30, and it is almost absent at station 140.

- Antarctic Intermediate Water (AAIW)--The salinity minimum layer at 600 to 1,000 m. depth defines the AAIW. This water mass is present at all stations, but it becomes less distinct as it spreads through the Gulf.

- North Atlantic Deep Water (NADW)--The NADW is present at all stations, but the core (deep, secondary salinity maximum) can be established only for station 66 and eastward.

- North Atlantic or Antarctic Bottom Water--The presence of this water mass can be determined from the salinity decrease below the NADW in the bottom waters (see insert for station 112 in fig. 2). A core for this water mass is not discernible. By the time the bottom water reached stations 30 and 43, it was thoroughly mixed with the overlying NADW, and the two masses could not be distinguished.

With the exception of the WGSW, each water mass enters through the Yucatan Straits and spreads through the Gulf. The characteristic features of the water masses become less distinct as they spread from the source.

The distinct difference in surface waters and strength of the SUW between the eastern stations (112, 94, and 129) and the more western stations indicates that a dynamic boundary in the surface and near-surface layers exists

between stations 129 and 140--that is, the flow through the Yucatan Straits moves as far westward as station 129. Further penetration to the west of these upper waters is much slower, however, and considerable mixing occurs as the water spreads westward.

The rising level of the cores of the SUW and AAIW westward from station 112 to station 129 indicates that the axis of the rapid, northward flow into the Gulf from the Caribbean is to the east of station 129. The varying thickness of the warm, surface water (fig. 3) and the upward slope of the isotherms to the west also depict these features. In addition, the depths of the isotherms indicate that the warm

upper waters are never again as deep in the central and western Gulf as in the Caribbean (station 112) and eastern Gulf (station 94).

The deepening of the NADW after entering the Gulf is probably because of spilling of the deep water over the shallow sill of the Yucatan Straits (at about 2,100 m.). The reason for shoaling of the core depth of the NADW in the western Gulf is unclear, but probably the current regime in the deep waters of the western Gulf is somewhat different from that in the upper layers.

The distribution of dissolved oxygen, expressed in milliliters per liter of sea water,

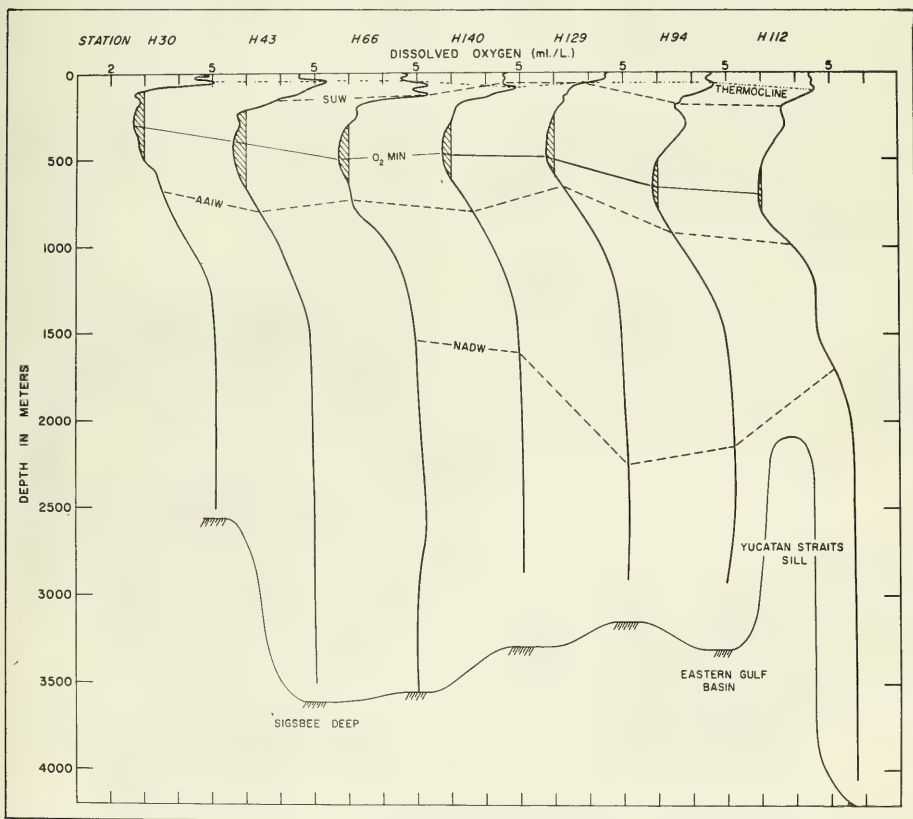


Fig. 4 - Vertical profiles of dissolved oxygen in the Gulf of Mexico showing the oxygen minimum layer (solid line), the top of the thermocline (dotted line), and the cores of water masses (dashed lines--from fig. 2).

is shown at stations along the section from the Yucatan Straits to the western Gulf in vertical profiles (fig. 4). Similar to the conservative properties of salinity and temperature used to characterize a water mass, the dissolved oxygen content (considered a "semiconservative" property) may be a valuable feature in identifying and tracing a water mass.

Along the transect, the surface oxygen--defined as the amount of oxygen in the upper meter of water--shows little variation (4.43 to 4.58 ml./l.) in the CSW and the WGSW. At 100 m., the CSW shows a submaximum oxygen concentration at the thermocline and near the top of the SUW. Two prominent maxima occur in the WGSW: one above and one below the top of the thermocline. These maxima probably are associated with the less stable layer of surface water (low oxygen concentration tends to remain low where stratification is stable).

A subminimum concentration of oxygen is associated with the SUW salinity maximum in the straits and eastern Gulf. In the central and western Gulf, the salinity core and the sharp oxygen minimum (3.52 to 3.57 ml./l.) become diffuse.

Throughout the world oceans, the dissolved oxygen content usually decreases to a minimum value with depth, generally between 700 to 1,000 m., and then increases again in the deep water. The minimum value, resulting from the oxidation of organic matter settling through the water column, is about 2.98 ml./l. at a depth of 700 m. in the straits of Yucatan.

In the western Gulf, the depth of the minimum layer rises to 300 m., and the concentration of oxygen decreases to 2.64 ml./l.

As the water passes through the Caribbean and into the Gulf of Mexico, the oxygen content decreases slightly. The oxygen minimum layer in the eastern Gulf coincides with a layer in which water density increases uniformly; this feature is not marked, however, in the western Gulf. The oxygen minimum rises somewhat above the density gradient as the cores of the AAIW and NADW decrease in depth in the western Gulf.

The progressive decrease in dissolved oxygen in the minimum layer from the Caribbean into the Gulf may be a result of insulation from replenishment--which occurs when the water is exposed at the sea surface--and an increase of organic debris in the water column. The oxygen minimum appears to lie at the boundary between the SUW and the AAIW in the eastern Gulf. The oxygen minimum and the salinity core of the AAIW in the western Gulf rise to a shallower depth than in the eastern Gulf, and the identity of the SUW becomes indistinguishable.

The oxygen content at the core of the NADW varies slightly (5.03 to 5.10 ml./l.) in the eastern Gulf along the transect. In the Yucatan Straits at sill depth, about 2,100 m. on the section, dissolved oxygen values were 5.6 ml./l.; however, concentrations did not exceed 5.28 ml./l. along the section in the bottom water of the Gulf.



STATE-OWNED SEED OYSTER GROUNDS IN LOUISIANA

The State of Louisiana owns and manages some 450,000 acres of natural seed oyster grounds where oysters grow wild. The seed oysters are generally selected and planted in September, October, and November when they reach the age of 12 to 16 months and a size of $2\frac{1}{2}$ to 3 inches. They grow rapidly from September to March reaching 4 to 5 inches in length and become more salty. Seasons are set for the taking of seed oysters in these areas depending upon annual conditions.

Oyster growers are permitted to gather wild seed oysters for planting on their privately-leased grounds. They are culled, separated and planted to get maximum food and growth harvest. This process is usually an annual operation, although in some cases may occur over a 2-year period. (Louisiana Conservationist)

REARING LUGWORMS FOR FISH BAIT

By John L. Taylor* and Carl H. Saloman*

The lugworm, *Arenicola cristata* (Stimpson), is a prospect for bait worm aquiculture. It is an excellent bait for sport fishes and has characteristics that suit it well for rearing under artificial conditions. Preliminary experiments show that lugworms can be grown in sediment trays submerged in a sea-water system. In 6 months, 7² worms worth \$3.00 were grown in a tray, 39 in. square (1 m.²) by 6 in. (15 cm.) deep, in a 6-in. layer of sand.

At present, the bait worm business depends on digging for two species--the blood worm, *Glycera dibranchiata*, and the clam worm, *Nereis virens*. The annual wholesale value of these worms in the United States is \$1.3 million, but both species have biological features that make them poorly suited for aquiculture.

This report introduces the idea of rearing the lugworm, *Arenicola cristata* (Stimpson), for fish bait (fig. 1). This species occurs along the Atlantic, Gulf, and Pacific coasts of the United States, and related species have worldwide distribution in shallow, temperate seas (Wells, 1962). Lugworms and other large sea worms are collected and sold for bait, but to our knowledge none is cultivated for that purpose (Pope, 1961).

Atlantic coast--the blood worm, *Glycera dibranchiata* Ehlers, and the clam worm, *Nereis virens* Sars (Westman, 1939; MacPhail, 1954; Klawe and Dickie, 1957). These worms supply bait for sport fisheries along the mid-Atlantic states for a variety of fishes that include blackfish, bluefish, kingfish, porgy, weakfish, sea bass, striped bass, and flounders (MacPhail, 1954; Hawkings, 1966; Anderson, 1968).

Worm digging is a part-time occupation for watermen because weather normally limits the collecting season to about 20 weeks between spring and fall. Where worms are abundant, a digger can work about 0.1 acre (400 m.²) of bottom on a favorable tide (about 4 hours) and collect 1,000-2,000 worms worth \$20 or less (Ganaros, 1962; Dow, 1964; Dow and Wallace, 1967; Anderson, 1968).

Sea worms for the bait trade come mostly from Maine, where production has grown from 118 thousand pounds in 1946 to more than 1.5 million pounds in 1966 (Dow and Wallace, 1967). Massachusetts and New Hampshire together market 100 thousand pounds of worms annually, and a small quantity is imported each year from the maritime provinces of Canada. Fishery statistics for the United States show that in 1965 blood worm production totaled 776 thousand pounds and clam worm production 809 thousand pounds.

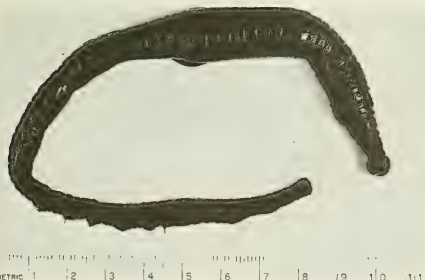


Fig. 1 - The lugworm, *Arenicola cristata* (Stimpson), from Tampa Bay, Fla., reared under artificial conditions for 6 months.

THE SEA WORM BUSINESS

The sea worm business was established in the United States about 1900 and is based on two species of worms collected along the north

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Note: Contribution No. 46.

Wholesale value of both species that year amounted to \$1.3 million (Lyles, 1967). Blood worms wholesale for about \$1.00 per pound (100 worms), and clam worms sell for about 60 cents per pound (50 worms). On the retail market, however, blood worms sell for as much as \$3 per pound, and clam worms bring about \$1.25. At these prices, marine bait worms are one of the most valuable products from the sea (Dow, 1964; Hawkings, 1966; Dow and Wallace, 1967).

Pope (1961) suggested that the culture of marine worms would have many advantages over digging them from tidal flats. It would be necessary to develop techniques to make sea worm farming as profitable as the highly successful practice of growing earthworms as a bait for freshwater fishes. A number of problems, however, face the prospective sea worm farmer.

PROBLEMS OF SEA WORM AQUICULTURE

The main difficulty in rearing sea worms is the procurement of enough young worms for farm stock. Blood and clam worms, like most other marine worms, spawn in the open sea where their young are dispersed by tides and currents. The problem is amplified because the juvenile worms require a special diet of plankton that would be difficult to furnish even if they could be obtained by induced spawning under artificial conditions, or by other means. Other factors that prospective growers would need to consider include choice of a seawater system (Clark and Clark, 1964; Parisot, 1967; Fuss and Kelly, in press), site location, capital investment, operating costs, marketing channels and, of course, potential profit.

THE LUGWORM-- A BAIT WORM FOR AQUICULTURE

The lugworm, *Arenicola cristata*, is good bait for a number of fishes. It has biological characteristics that make it better suited for aquaculture than blood and clam worms, or other sea worms that produce free-swimming larvae. Furthermore, preliminary rearing experiments indicate that engineering and economic aspects of lugworm aquaculture present no serious problems.

In Tampa Bay, Fla., *A. cristata* is dug in intertidal areas as a fish bait for private use, and occasionally small lots are sold by bait 1/L. W. Clay, 4916 Camellia Way, South, St. Petersburg, Fla. 33705.

dealers for 50 cents per dozen. On productive grounds, 150 to 200 lugworms can be dug during a low tide. The worms keep well and stay alive for 2 or more weeks in a submerged bait bucket. The lugworm is regarded by local fishermen as an excellent bait for sheepshead, *Archosargus probatocephalus* (Walbaum), spotted sea trout, *Cynoscion nebulosus* (Cuvier), red drum, *Sciaenops ocellata* (L.), and black drum, *Pogonias cromis* (L.). Lugworms are large enough so that several hooks can be baited by sectioning a single worm, and the tough skin holds a hook well. Fishing trials by a local fisherman¹ showed that as many as 40 sheepshead can be caught on 10 lugworms.

The foremost characteristic that makes *A. cristata* well suited for aquaculture is its mode of reproduction. Eggs are fertilized in the female burrow and pushed out in a jelly-like capsule that is anchored to the burrow by a short stalk (fig. 2). Larvae develop inside the capsule, emerge after several segments have developed, and then dig into the sediment. Young worms, therefore, can be collected by simply gathering egg capsules from tidal flats where they have been deposited.

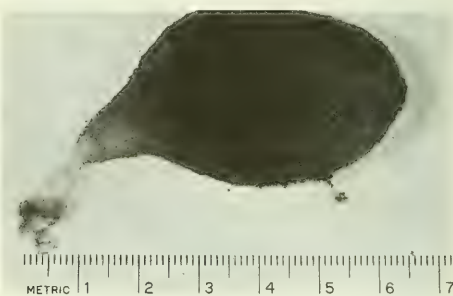


Fig. 2 - Egg capsule of the lugworm, *Arenicola cristata* (Stimpson), from Tampa Bay, Fla.

Feeding habits of the lugworm are also suited for aquaculture. Embryos are self-sufficient inside the egg capsule and, after hatching, the worm feeds on mixed organic detritus available in sediments. Other advantageous features of lugworms include rapid growth, tolerance of low dissolved oxygen, a sedentary habit, and tolerance to crowding.

REARING LUGWORMS

The first rearing of lugworms was accidental. In September 1966, 12 large specimens

were discovered in trays of sediment that had been submerged for 1 year in holding tanks of an experimental seawater system. The trays contained transplants of sea grasses; apparently, young lugworms had been introduced to the trays attached to plant sprigs. Sand and gravel in the trays came from a building supply yard, and the seawater system was equipped with a filtration system that eliminated plankton and other particulate material. Filamentous algae also entered the tanks on sea grass leaves and became established on the walls. It provided food for the worms when fragments sloughed off and accumulated on sediment in the trays.

The second success at rearing lugworms was by design. On June 15, 1967, a plywood sediment tray, 39 in. square and 12 in. high (1 m.² by 30 cm. high), was filled as before with a 2-inch (5-cm.) layer of small river gravel covered by 6 in. (15 cm.) of white sand. The bottom of the tray was perforated and covered with fine plastic screening to allow water circulation through the sediments. The tray was submerged in a holding tank

that contained a good growth of algae, and a lugworm egg capsule from Tampa Bay was added. The egg capsule contained thousands of embryos--enough to produce a lugworm population that would be limited only by available food and space.

When the tray was raised on November 11, 1967, 72 lugworms were recovered from the sand-layer of sediment. Whole wet weight of the worms was slightly over 1 lb. (462 grams) and average length was 6 in. (15 cm.). On the basis of the local retail price of 50 cents per dozen, the lugworms produced in less than 6 months were worth \$3. If two crops of lugworms could be produced in 12 months, yearly production on an area of sediment 39 in. square (1 m.²) would be about 2 lbs. of worms worth \$6. Whether or not such a return warrants the expenditure that would be required to establish a commercial enterprise has not been demonstrated. Results of our attempt to culture lugworms are encouraging, however, and the possibility is good that a practicable method can be developed for rearing them on a commercial scale.

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Fishing is one of Canada's major industries. The west coast is an important center. Large canneries handle great herring catches.

The "brailer," or huge scoop net, is being guided by man at end of pole. It lifts 2 tons of herring at a time from great net still in water. A winch supplies the power.

(National Film Board Photo)

FOREIGN

CANADA

WIDE SEARCH FOR QUEEN CRAB IN N. ATLANTIC STARTS

Broad areas of the Gulf of St. Lawrence will be explored this year to determine distribution and abundance of queen crabs. It will be done by the Industrial Development Service of the Canadian Federal Department of Fisheries.

Atlantic queen crab (*Chionoecetes opilio*) has become an increasingly important resource in the Atlantic commercial fishery. It was stimulated by experimental catching and processing under federal-provincial cost-sharing arrangements during the past 3 years.

Last year's catch of queen crab by Atlantic fishermen was 1.5 million pounds.

Exploration Is Urgent

Because intense fishing pressure on known stocks is expected, exploration becomes extremely urgent. This is because a crab trap fishery could revitalize depressed areas and ensure that sufficient stocks exist for increasing demand.

About 40,000 square miles of the Gulf of St. Lawrence may produce queen crabs in commercial quantities. Because of area size, a systematic search pattern must be used.

Lines drawn horizontally and vertically at $2\frac{1}{2}$ -mile intervals will provide basic pattern. Decca positions at each point will permit accurate and easily recorded search. While traps set this way could miss small concentrations of crabs, any area of significant population would certainly be bisected, and a more intensive search could be carried out.

The prime areas plotted represent over 5,000 positions to be fished. It will take at least 2 seasons to complete the survey.

Vessels and Gear

Two vessels are being chartered by the Industrial Development Service to carry out the exploration. One is the 65-ft. combination vessel "St. Cecilia II" built last year for the Cheticamp Fish Co-op Ltd., Cheticamp, N. S. She has begun operating in the Gulf off Cape Breton. A second vessel will join later.

Crab traps in the sampling will be of standard size. Frozen herring bait will be used. All crabs caught will be returned to the water immediately after being weighed and measured.

Information Valuable

Information acquired will help considerably an investigation by the Fisheries Research Board of Canada into the life history of the queen crab. Added to commercial fishermen's information, it will help enlarge knowledge about quantities of commercial-size crabs and the effects of environment and season on abundance and biology.

A general report at the end of the 1968 program and interim reports will be published.

Provincial fisheries departments also are undertaking local explorations adjacent to their coasts under federal-provincial cost-sharing arrangements. ("Fisheries of Canada," June 1968.)

* * *

TUNA SEINER 'GOLDEN SCARAB' AUCTIONED

The Canadian tuna seiner Golden Scarab was auctioned recently, but the controversy over the fate of the nation's subsidized tuna fleet and the replacement of local fishermen by foreigners boils on.

The Golden Scarab is one of five 170-foot seiners built since 1965 for C\$2.2 million

Canada (Contd.):

each. The Canadian government paid a 50-percent subsidy. A tuna-processing complex was constructed at St. Andrews, New Brunswick, to stimulate the fishing industry and to increase employment. Many fishermen contended that the tuna firm used public money to their disadvantage.

Foreigners the Main Issue

The central issue is the use of foreign fishermen. Three years ago, on her first voyage, the Golden Scarab released her Canadian crew in Central America, hired a U. S. captain and a Costa Rican-Mexican crew. In the 3 years that followed, the vessel made no landings in Canadian ports. On Jan. 29, 1968, when she reentered Canada for the first time, her creditors seized her.

The Canadian fishermen claim that 4 other vessels do the same thing. After negotiating a contract in Canada with local fishermen, the vessel owners give them a "take-it-or-leave-it" pay cut when they reach Central American ports. Most crewmen choose to return home, and the vessel owners hire U. S. skippers and foreign crews.

The Canadian fishermen are urging that the foreign crews be replaced by Canadians.

* * *

NEWFOUNDLAND FISHING INDUSTRY IN TROUBLE DESPITE RECORD YEAR

In 1967, Newfoundland's fisheries set records in landed weight and value. Early statistics showed a catch of 746 million lbs., 11 percent above 1966, according to Aiden J. Maloney, Minister of Fisheries. But markets weakened, particularly for fresh-frozen fish in the U. S. The catch brought only C\$26.8 million--a record, too, but only 1% over the 1966 value. Few persons are predicting better prices or greater sales in 1968.

Catholic Church Makes Change

The market started to crumble in 1966 when the Roman Catholic Church lifted its ban against eating meat on Friday. One fisheries department official said the decline was significant first among institutional buyers, such as hospitals and schools, then spread gradually throughout the consumer

market. Falling demand resulted in falling prices. To some extent, this has affected all North American producers.

The lower export prices were reflected in lower prices paid by Newfoundland fish-plant operators to the fishermen.

Another factor was the establishment, with provincial government encouragement, of new fish plants in the past 3 years.

Subsidized Foreign Competition

Adding to the province's difficulties was the success of heavily subsidized and more efficient European producers in closing their home markets to Newfoundlanders and making inroads into the U. S. market.

While prices fell, overhead costs in the fish plants rose.

Prices Fall

In 1965, a pound of fresh frozen fish sold for 29¢ in the U. S. It returned 5½¢ a lb. to the Newfoundland fisherman. But in 1967, this price dropped to 21¢, or 3½¢ to the fisherman. P. J. Antle, general secretary of the Newfoundland Federation of Fishermen, fears the fisherman's price could drop to 2½¢ this year.

Antle noted the decision of the Ross Group, London, to cease operation of the Ross-Steers frozen-fish plant on the south side of St. John's harbor. Also, the Job Bros. & Co. plant gave up.

When fresh-frozen prices declined in 1967, many inshore fishermen followed Antle's advice to salt their catches rather than accept what the fish-plant operators were offering. Unfortunately, the salt-fish market declined too. Fishermen in 10 communities on Trinity and Conception Bays protested the low prices by staying ashore.

The devaluation of the British pound in late 1967 also affected several West Indian currencies. This resulted in a loss of export sales there, notably to Jamaica. The result was a high carryover of salt-fish stocks.

By April 1968, Newfoundland fish wholesalers had 9-10 million lbs. of salt fish on their hands. To facilitate marketing this year's catch, the federal government announced in

Canada (Contd.):

May it would buy all unsold salt cod stocks in eastern Canada at the end of the present market period--around the end of July.

Government to Buy Unsold Fish

Federal Fisheries Minister H.J. Robichaud said the purchased fish would be sent as aid to underdeveloped countries. None of these countries would be normal importers of salt fish from Canada. The cost to the Fisheries Price Support Board, which is buying it for the federal government, will be about C\$2.2 million. The World Food Program of the United Nations will receive about \$500,000 worth immediately; another \$50,000 worth will aid South Vietnamese refugees.

Carryover was not limited to salt fish. The declining U.S. market left Newfoundland fish processors with 30-40 million lbs. of fresh-frozen fish on their hands--fish already bought from the fishermen.

Two more difficulties threaten:

U. S. fish processors are asking U. S. Customs to determine if Canadian producers are dumping fish products on the U.S. market.

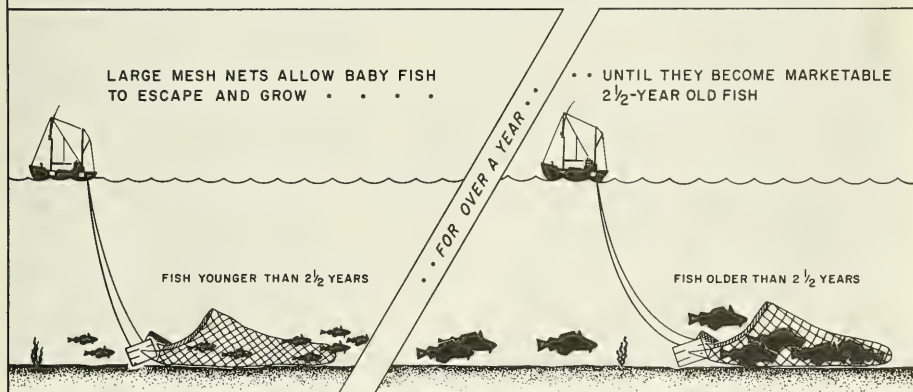
Sales of Greenland halibut or turbot have been increasing in recent years. Americans say the name is misleading because the fish is neither halibut nor comes from Greenland.

The Outlook

Some observers say things have to improve because they cannot get much worse. The disappearance of the fishing industry seems too unreal. One fisheries department official sees hope in an expanded and more efficient deep-sea fleet. Modern, more efficient methods of harvest are fine but the problem of marketing the catch remains. The official suggests that the long-range answer may lie in sales of fish meal to underdeveloped countries. ("Financial Post," June 15.)



HOW THE LARGE MESH WORKS





British fishermen hauling in herring catch. Shoals swim near surface and fine nets are trailed for them.
(Photo: British Information Service)

EUROPE

Norway

EUROPE'S NO. 1 FISHING NATION

Norway, Europe's leading fishing nation and fifth in the world, set a record in 1967. For the first time, she landed over 3 million metric tons, despite numerous bans on fishing for reduction purposes. The substantial increase over 1966, a record year too, was accounted for by North Sea mackerel. Reduced demand and low prices for fish meal and oil lowered the income of fishermen who supply the reduction industry. This development, and a minor reduction in landings of cod and other species, produced a smaller total first-hand value than in 1966. It happened despite the peak in total landings.

Prices abroad fell for principal fish products like meal and oil, stockfish, and frozen-fish fillets. But these were more than offset by record exports of meal and oil. The result was a 13% increase in the export value of fish products in 1967.

The expansion of the purse-seine fleet reached 500 power-blocked vessels in 1967.

Norway's exports of fish products to the U. S. hit a high of \$32 million in 1967, due mainly to large shipments of fish meal.

Government Support Steady

Government support continued at about the level of the preceding years. There were no significant changes in government fisheries policy during 1967. There are indications of a more liberal approach emerging--for example, the recent extension of export rights to the Nordic Group for frozen-fish-fillet shipments to the U. S.

Short-Term Outlook Good

The short-term outlook for the fisheries is fairly good, though marketing conditions are far from satisfactory for some principal fish products. The total yield of cod and related fish species for Jan.-Apr. 1968 probably was higher than last year's, but total catches of herring, mackerel, and capelin were one-third smaller than the record first third of 1967.

The most significant development in fish research in 1967 was the government decision to build a US\$3 million ocean research vessel planned for 1969/70 operation.

Fishing Fleet

The expansion of the purse-seine fleet peaked in 1967, then interest declined rapidly. This reflected sharply falling first-hand prices, and numerous bans on fishing for reduction purposes. It is commonly believed that the purse-seine fleet of about 500 vessels equipped with power-blocks is more than adequate to land the shoal fish that can be processed by the existing fish-reduction industry.

In the cod fisheries, fleet modernization continued during 1967. The renewal is concentrated on small craft (less than 25 feet) for coastal operation, and large long-liners and trawlers (over 60 feet) for ocean fishing. There is less interest in replacing medium-sized vessels.

Several purse seiners were equipped to transport large quantities of herring and other shoal fish in cooled salt water in 1967. This keeps fish fresh for several days. It may bring about a substantial increase in earnings of purse seiners, provided new foreign markets for fresh fish can be found abroad.

Catch and Value

In 1967, the fishing fleet operated mainly in the waters of 1966. Icelandic herring was fished farther north than before (near Bear Island). Mackerel were abundant in the North Sea and off Shetland and stimulated fishing there.

The 1967 fish catch, including crustaceans, reached a high of 3,003,700 metric tons, 13.5% above 1966. The exvessel value, state price support and transfers from the Herring Price Stabilization Fund included, decreased 13.7% to \$161 million. This sharp fall in exvessel value was caused primarily by price cuts in fish for reduction purposes--herring, mackerel, capelin. And this reflected reduced prices for fish meal and oil (see table 1).

Norway (Contd.):

Table 1 - Norway's Landings, 1966-67; Use of Landings, 1967

Species	Landings		Utilization 1967						
	1967	1966	Fresh	Frozen	Dried	Salted	Canned	Reduction	Bait
	(1,000 Metric Tons)								
Capelin	402.8	379.6	-	-	-	-	-	402.8	-
Herring:									
Winter	371.6	460.9	17.1	32.2	-	20.2	8.1	292.4	1.5
Fat	346.0	148.1	1.2	-	-	2.2	0.2	337.6	4.7
Small	106.4	78.5	0.4	-	-	0.1	10.9	94.8	0.2
Fjord	1.2	1.3	1.0	-	-	0.2	-	-	-
North Sea	335.8	454.9	5.0	2.0	-	0.9	0.3	327.5	-
Icelandic	52.1	42.2	-	0.3	-	7.7	-	44.1	-
Total	1,213.1	1,185.9	24.7	34.5	-	31.3	19.5	1,096.4	6.4
Mackerel	866.6	484.0	5.2	12.0	-	3.0	1.8	841.3	3.2
Cod	196.9	197.0	18.5	49.2	71.8	54.0	2.4	0.8	-
Saithe	119.8	142.6	7.6	44.7	31.4	33.7	0.8	1.5	-
Haddock	40.0	62.5	7.8	27.1	2.9	-	1.0	1.1	-
Other	172.5	204.1	27.5	35.8	9.2	24.4	16.0	58.7	1.7
Total	3,011.7	2,655.7	91.3	203.3	115.3	146.4	41.5	2,402.6	11.3

Note: Totals may not add due to rounding.

Source: "Fiskets Gang," published by the Norwegian Fishery Directorate, March 7, 1968, No. 10.

Record catches of mackerel in the North Sea made up the entire increase in the 1967 fish yield. The yield of other main species of fish remained at 1966 levels (cod and capelin or decreased (saithe and haddock). Due to oversupply of fish raw material, the fishermen's marketing organizations banned fishing for reduction purposes 12 times in the North Sea, and 18 times in North Norway, during 1967. A quota system was introduced during second-half 1967.

Herring and Sprat

Until 1965, the herring and sprat catches were the largest. In 1967, these increased about 2 percent: to 1,226,700 tons. Larger

catches of fat herring and small herring more than compensated for reduced yields from the North Sea and winter herring fisheries. The 1967 yield of sprat, raw material for the brisling "sardine," was 13,600 tons, slightly above 1966. Including price support and transfers from the Herring Price Equalization Fund, fishermen received \$41 million for deliveries of herring and sprat--only 70% of comparable 1966 income.

Cod

The 1967 cod yield was 196,900 metric tons, the same as 1966. Catches of spawning cod fell by 3.8% to 57,900 tons, whereas



Fig. 1 - On herring grounds off Norway's West Coast, large purse seine has been set around submerged shoal. Seine has been pursed and net is being pulled toward mechanized dories to confine fish more closely in net's bag. (Photo: FAO/H. Kristjansson)

Norway (Contd.):

small improvements were recorded for Finnmark young cod and of other cod from Norwegian and distant waters. The first-hand value of the cod catch, support payments included, was \$36.6 million, down 0.3% from 1966.

Other Species

In 1967, the aggregate yield of fishes other than herring, sprat, and cod rose 26%--to 1,580,100 metric tons. Purse seining for mackerel in the North Sea and off Shetland produced a record 866,600 tons. Catches of capelin off Finnmark increased 6.1% to 402,800 tons.

Capelin have been very abundant off Finnmark in winter and spring of the last 3 years, 1968 included. This, combined with limited local reduction plant capacity, has created serious marketing problems for capelin. The problems have been met partly by shipping capelin to plants in other districts, and partly by temporary fishing stoppages. Exvessel income from the capelin catch, reflecting poor prices for fish meal and oil, was only about 60% of income from smaller 1966 catch.

In 1967, the catch of saithe dropped 16% to 119,800 tons, haddock dropped 36% to 119,800 tons. These species, plus cod, are the most important raw material for frozen-fish fillets, stockfish, and klipfish.

No significant changes were recorded in landings of high-priced fish and crustaceans: eel, salmon, halibut, crab, lobster, and shrimp.

Disposition of Catch

Deliveries of fresh and iced fish fell 13% to 91,300 tons in 1967. Unchanged, or lower, deliveries were recorded for all major species sold for fresh consumption; haddock, cod, saithe, salmon, winter herring, North Sea herring, and mackerel. (Shrimp and crab are excepted.)

Extremely difficult marketing conditions for frozen-fish fillets abroad reduced over 20% (to 203,300 tons) the fish raw material purchases of the freezing industry. The stockfish industry apparently hoped for an end of the Nigerian civil war and resumption of normal deliveries to this market. It increased fish purchases in 1967 (cod and related species) by 5.1% to 115,300 tons.

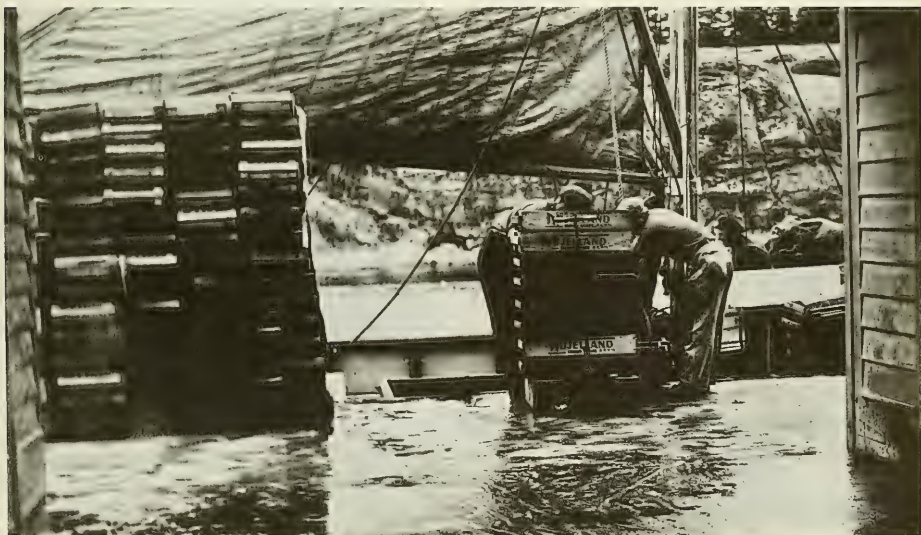


Fig. 2 - Unloading brisling (sardines) at canning plant. (Norwegian Official Photo)

Norway (Contd.):

The fish-salting industry received 114,500 tons of fish, except herring and sprat, or 7.8% above 1966. Herring salting claimed 13,600 tons of fish raw material, or 58% of the 1966 quantity.

Fish deliveries to the canning industry shrank over 15%, to 41,500 tons, in 1967; this resulted from smaller purchases of small herring and sprat. The downward trend in sales of fish for bait was reversed in 1967. It probably reflected a temporary increase in use of long lines.

As in 1966, the most notable production gain in 1967 was in fish meal and oil industry. Deliveries of herring, mackerel, capelin, and other species to reduction plants increased 21%--to a new high of 2.4 million tons.

Foreign Trade

In 1967, income from exports of fish products rose 13% to \$244 million. This was 14% of Norway's exports, slightly higher than 1966 (see table 2).

	1967	1966
	. . . (Metric Tons) . . .	
Frozen Fillets:		
Haddock	10,966	14,602
Cod	25,583	26,056
Coalfish	19,565	17,828
Herring	6,689	8,435
Other	6,298	5,875
Total frozen fillets	69,101	72,796
Frozen herring	13,167	16,691
Canned Fishery Products:		
Brisling	5,963	7,539
Small sild sardines	13,463	12,637
Kippers	3,348	3,386
Shellfish	523	787
Other	4,133	4,539
Total canned fish	27,430	28,888
Fish meal	494,785	257,289
Herring oil, crude	165,721	80,841

Source: "Fiskets Gang," Jan. 20, 1968, and Jan. 26, 1967.

As in 1966, fish meal was the No. 1 fish export in 1967 in volume and value. Such exports nearly doubled to a record 495,900 tons. Export income for fish meal was \$75 million, up 55%. This implies an average price reduction from \$184 in 1966 to \$150 per ton in 1967. Exports of fish oil rose 105% in volume and 45% in value--165,700 tons and \$20 million.

The frozen-fish fillet industry, the other growth industry in recent years, suffered an export setback. Exports dropped 5.1% to 69,100 tons in 1967, and a nearly 12% drop to \$32.5 million. Marketing conditions abroad were very difficult during most of 1967, due to oversupply; prices obtained were low. Due to Civil War in Nigeria, the principal market for "African-quality" stockfish not easily marketable elsewhere, 1967 exports of stockfish fell 55% from 1966 level. The Nigerian market, plus greater 1967 production, almost doubled inventories to 20,000 tons at the end of 1967.

Unlike most other major fish products, markets for klipfish were generally satisfactory. Increased sales, particularly in Brazil and Portugal, boosted klipfish exports to 40,900 tons, 13% above 1966. Average export prices obtained were 4.5% higher in 1967 than in the year before.

In 1967, canned-fish exports increased 5.4% in volume to 38,000 tons.

Exports to U. S.

Exports of fish products to the U. S. rose over 50% to record \$32 million in 1967. Fish meal accounted for it: exports rose from 22,700 tons in 1966 to 100,800 tons in 1967. Shipments of canned-fish products, the principal fish product in value, remained at 1966's \$10 million. In frozen-fish fillet exports to U. S., fierce competition, and sharply lower prices, reduced volume 21%, to 7,700 tons, and value 25% to \$3.9 million.

Norwegian Imports

In 1967, imports of fish and fish products into Norway were 23,200 tons and \$9 million, compared to 41,200 tons and \$11.6 million in 1966. The most important fish products imported were salted cod for klipfish industry, and salted herring and canned fish delicacies for domestic consumption. As in 1965-1966, imports of U. S. fish products were negligible.

Aid to Fishermen

In 1967, the average price received by fishermen per ton of winter herring fell 20% to \$37. This reflects partly lower prices paid by fish reduction industry, and partly the smaller portion of 1967 catch of winter herring marketed fresh and frozen and eligible for price support.

Norway (Contd.):

Outlook

Table 3 - Average Prices to Fishermen in \$ Per Metric Ton

	1966	1967
Halibut	715	791
Spawning cod	186	205
Finmark young cod	171	159
Saithe	95	93
Mackerel	50	29
Tuna	443	280
Dogfish	125	126

Source: Economic Survey 1967, Central Bureau of Statistics, Oslo.

In 1967, \$27 million, or 16.8% of exvessel value of fish catch, was appropriated by the Government for price support, reduction of costs for tackle and bait, and for modernization measures. No price support was given for fish delivered to the fish-reduction industry. An undisclosed export income reduction in the Nov. 1967 round of devaluations was partially offset by a \$1 million government appropriation.

Government Policy

No significant changes took place in government fisheries policy during 1967. The fisheries still are characterized by fishermen's marketing organizations wielding exclusive rights in exvessel price stipulation and marketing of about 98% of total landings, centralized exports of many principal fish products, state-supported lending facilities (Norwegian Fishermen's Bank), and government subsidization of fish prices and certain cost items.

There are indications of a changing climate in official fisheries policy. Recently, the Ministry of Fisheries extended export rights to the "Nordic Group" for frozen-fish fillets to the U. S. Nordic Group A/L, an organization of 14 independent producers, now joins Frionor as a Norwegian sales organization in the U. S. Also, in a recent speech, Minister of Commerce and Shipping, Kaare Willoch, advocated liberalization of fish exports.

The short-term outlook seems fairly good--despite dire warnings that Norway is heading into the worst fisheries crisis since the mid-1930s. In early 1968, the seasonal fisheries' yield, and marketing prospects for several important products, notably frozen-fish fillets, portend at least a normal year. However, marketing conditions abroad for other main products, like fish meal and oil and stockfish, are less satisfactory. They may cause further hardship for those in these fisheries and processing.

Early 1968 Yield

The yield of principal seasonal cod fisheries, spawning cod and Finmark young cod, was 91,800 tons in the third week of April. This was 25% above the 1967 period. The fish filleting industry has processed 23,000 tons of the total, an increase of 77% over 1967; deliveries of cod for hanging (stockfish) fell 12% to 31,600 tons in Jan.-Apr. 1968. Complete failures of the fat herring and winter herring fisheries reduced deliveries of fish raw materials to the reduction industry by one-third (to 0.5 million tons) in Jan.-Apr. 1968, despite record landings of capelin.

The 1968 output of the fish-reduction industry will drop substantially from the 1967 record of 470,000 tons of meal and 310,000 tons of oil--unless yields of North Sea herring, mackerel, and other shoalfish (small herring, fat herring, sandeel, Norway pout) set record.

Note: All tons are metric.

* * *

HOW INDUSTRIAL FISH LANDINGS WERE USED (JAN.-MAY 1967-68)

"Fiskets Gang," published by the Norwegian Fishery Directorate, reported June 6 these uses of industrial fish from January-May 1967-68:

Norway (Contd.):

Species	Total	Iced Fresh		Frozen		Salted	Canned	Animal Food	Meal & Oil
		Export	Domestic Consumption	Edible	Bait				
(1,000 Metric Tons)									
Herring:									
North Sea . . .	33.6	4.0	-	2.0	0.1	0.3	1.5	-	25.7
Fat	100.7	-	0.1	1.2	2.7	-	0.1	-	96.5
Small	4.2	0.1	0.2	-	0.1	-	2.1	-	1.6
Winter	25.6	4.4	7.2	5.1	0.7	3.5	2.0	-	2.8
Fjord	0.3	-	0.2	0.1	-	-	-	-	-
Total 1968	164.4	8.5	7.7	8.4	3.7	3.8	5.7	-	126.7
Total 1967	511.2	18.1	2.2	33.2	3.2	20.4	10.0	-	424.2
Capelin . . .	497.1	-	-	-	-	-	-	-	497.1
Norway pout .	13.6	-	-	-	-	-	-	0.5	13.1
Total 1968	510.7	-	-	-	-	-	-	0.5	510.2
Total 1967	421.9	-	-	-	-	-	-	-	421.9
Mackerel:									
1968	240.6	0.3	1.1	3.0	1.9	0.8	0.2	0.3	233.0
1967	331.1	0.2	0.9	2.2	1.4	1.0	0.2	-	325.3

1/Through Mar. 25, 1968; Mar. 27, 1967.

Notes: (1) Original data converted from hectoliters (hl.) using 93 kilos=1 hl. for all species except capelin (100 kilos=1 hl.)

(2) Totals may not add due to rounding.



France

THE FISHERIES OF FRANCE

France's ranks 16th among the world's fishing nations and 6th among the 36 European fishing nations. She has 1,870 miles of coastline on the English Channel, the Atlantic Ocean, and on the Mediterranean Sea. Yet she remains a net importer of fishery products. The industry is in trouble "because its structure retards development, investment capital is inadequate, the market disorganized, and international competition increasing."

CATCH AND PRINCIPAL SPECIES

Since 1948, the total catch of fish and shellfish has been rising. It increased 57 percent from 512,800 metric tons to a record 804,800 tons in 1966, on a live-weight basis. Most of the increase in recent years may be attributed to new and more powerful vessels. These permit fishermen to exploit offshore resources. Catch value was over US\$200 million in 1966.

The industry does not depend on a few species. Large quantities of cod, haddock, hake (European), pollock, whiting, herring, pilchard (European), albacore, yellowfin, mackerel, mussels, and oysters are landed. Cod is valued at about US\$14 million. It is the most important fish in quantity and value.

Since 1961, landings of yellowfin, tuna, mussels, haddock, saithe (pollock), whiting, and cod have increased; landings of oysters, hake, mackerel, and herring declined.

Salt-Cod

The salt-cod fishery is on the Grand Banks off Newfoundland. Large trawlers of 1,000 to 1,800 tons are used. These make 2 or 3 fishing trips each year, beginning in February and continuing until mid-December. In 1966, production of salt-cod was about 46,000 tons. The newest vessels are equipped to quick-freeze catches. This may become more common than salting cod in the near future. Frozen cod production began in the early 1960s.

Tuna

The tuna industry has been developing steadily. In 1966, 44,000 metric tons were caught--up 6 percent over 1965. The 1966 catch was worth 100 million francs (US\$20 million). Four species dominate the catch--albacore, yellowfin, bluefin, and skipjack.

The tuna fishery is divided into the European season and the African season:

European: Main species are bluefin and yellowfin. These are caught in the Atlantic from nearly every important French port between Camaret and Saint Jean de Luz. Concarneau and St. Jean de Luz are the leading ports. About 572 vessels are equipped for tuna fishing, 54 over 1965. The 1966 yellowfin

France (Contd.):

catch was 12,520 metric tons, lower than in 1965; bluefin catches increased to 2,613 tons. Improved prices for both species showed market far from saturation.

There are problems, particularly on the Basque coast. There canneries are working below capacity because catch increases were only modest and competition from the fresh fish market is keener.

African: Two separate fleets are involved. One, based at Dakar, West Africa, has tuna boats and boats with refrigerated holds, and works in winter and spring. The second fleet, tuna freezer boats, operates year round in the Gulf of Guinea.

The catch of the refrigerated tuna boats was 7,985 tons in 1966; this included 5,878 tons of albacore and 2,107 tons of skipjack. The 34-vessel freezer fleet (7,230 GRT) caught 20,866 tons--about 14,000 tons of albacore and the rest skipjack. Total African catch was 28,900 tons.

Shellfish

Since 1957, there have been large increases in production of oysters, scallops, and mussels. Catches have doubled or tripled in some cases. A large market for shellfish is developing.

Outlook

Cod and herring catches have been dropping over the years. Most nations fishing these species in the North Atlantic report declining catches. Overfishing may have reduced available stocks and this is disturbing for the future. Other industry problems include: extension of fishing limits by other nations, declining prices, and increasing competition from other nations for the resource and the markets.

Landings have been increasing steadily. Likely, they will continue in the near future. This optimistic outlook is based on a modernization of the industry, which would offset the difficulties.

Fishing Areas

Small- and large-scale operations are conducted off Greenland and Newfoundland, the

North Atlantic, North Sea, Mediterranean Sea, Atlantic Coast of Africa, and France's coastal grounds. Coastal and offshore waters are most productive. These produce around 500,000 tons annually. Cod and tuna are very important distant-water fisheries, especially the salt-cod fishery on the Grand Banks.

In 1966, deep-sea fishing yielded 53,000 tons; landed value was 81.3 million francs (US\$16 million). Salted cod were 46,000 tons of the total, a little more than in 1965. Tuna are caught in European and W. African waters. The fresh sardine fishery is conducted off France's Mediterranean and Atlantic coasts; the frozen sardine fishery is off Morocco.

Ports

In 1966, the leading ports in order of importance were:

Port	Tonnage
	Metric Tons
Boulogne	146,000
Concarneau	68,000
Lorient	61,000
Fecamp	31,000
La Rochelle	24,000
Douarnenez	24,000
Bordeaux	17,000
Dieppe	13,000
Le Guilvinec	12,000
St. Jean de Luz	11,000
St. Malo	10,000
Port-en-Bessin	9,000
Les Sables d'Olonne	8,000
Cherbourg	8,000

Often, the fisheries are centralized in certain ports. The fresh fish trawlers that operate off Iceland, Norway, and in the North Sea are based in Boulogne and Dieppe. Trawlers that work the Atlantic as far south as Mauritania and north to Ireland dock in Lorient and La Rochelle. Trips of fresh-fish trawlers normally run 10-15 days. Deep-water trawlers (salt-cod) operating in the northwest Atlantic are based mainly in Fecamp, Bordeaux, and St. Malo. Though Concarneau and St. Jean de Luz are important tuna ports, tuna vessels operate out of nearly every important port. St. Jean de Luz also is an important frozen-sardine port. Les Sables d'Olonne is another principal sardine port. Lobster vessels are important in Camaret. Many ports, including Port-en-Bessin and Douarnenez, are home for line-fishing vessels.

France (Contd.):

FISHING VESSELS

There are about 14,000 vessels totaling 287,992 gross tons in France's relatively modern fishing fleet. Nonrefrigerated trawlers, generally under 250 gross tons each, are most numerous type. About 10,000 vessels are under 10 gross tons, and only 64 are over 500 tons. The number of medium-sized vessels, especially those 25-50 tons, has declined sharply; so has number of under-10 GRT vessels.

The fleet has declined by over 400 vessels since 1961; however, total gross tonnage increased because of significant changes in size and type of power. The fleet has been upgraded, as stern trawlers, moderate-sized trawlers, combination boats, and freezer trawlers have replaced the sailing fleet, coal-burning steam trawlers, and drifters.

Number and gross tonnage of vessels:

	Number of Vessels	Tonnage
Dec. 31, 1960	14,315	255,181
Dec. 31, 1965	13,566	287,776
Dec. 31, 1966	13,906	287,992

In 1962, the deep-sea fleet had 32 vessels: 22 trawlers used exclusively for salting catches, 6 trawlers for both salting and freezing, one all-freezing vessel, and 3 other specialized trawlers.

The construction of freezer vessels is a very significant development of recent years. Vessels no longer are being built exclusively for salting fish. The question now facing the industry is whether a combination vessel (salting and freezing) or a purely freezing vessel is best for its future.

An interesting aspect of fleet modernization is that many large vessels were and are being built in West Germany, Poland, Belgium, and the Netherlands. There, costs were less. Stern trawlers were gradually accepted, but only the largest have complete quick-freezing plants.

FISHERMEN

The number of fishermen has declined over the years to about 40,000: 35,000 are self-employed, about half in South Brittany. Also, an estimated 50,000 workers work in shell-

fish culture, 13,000 in canneries, 2,000 in curing plants, and perhaps 8,000 in industrial fish plants and other segments of the industry, including marketing.

Fishermen are paid under 2 basic wage plans. In the "industrial" fishery (vessels over 100 GRT), crews receive a guaranteed minimum wage, or a share of the catch proceeds, whichever is greater. In other types of fishing, only the share system is used.

MARKETING

Consumption

Per-capita consumption of fish and shellfish is about 13 kilos, the largest in the Common Market but low compared to other European nations. About two-thirds of seafood consumption is fresh, the rest frozen, canned, and salted. Consumption of canned and frozen fishery products is increasing; that of dried, salted, and smoked products is declining. Country-wide promotion campaigns are conducted. There remain wide variations in fish consumption between different regions. Retail prices for fishery products are high; fish are not inexpensive compared with meat.

Processing

The frozen-fish trade is relatively small compared with the European trade. This is because storage, distribution facilities, and advertising are inadequate. Parts of the industry are now paying more attention to this trade.

Consumption is expected to reach 50,000 tons per year by 1970, triple the present amounts. The interest in increasing production of frozen fishery products is shown by the program of converting deep-sea salting vessels to freezer trawlers.

France produces the largest amount of canned fish in Europe, between 80,000-100,000 tons annually. Rigid controls produce high-quality. The industry consists of about 150 factories, mainly in northern France. There is a concentration in number of plants and significant increases in productivity.

Cod, herring, sardines, mackerel, and anchovies are all cured. Cod is salted aboard ship; additional processing is done ashore. Salted cod is the largest item of cured fish;

France (Contd.):

about 46,000 tons were produced in 1966, far below 1962's 67,000 tons.

Very small amounts of fish meal and oil are produced; about 12,000 tons of fish meal per year.

Distribution

About one-fourth of all landings are shipped to Paris for local consumption, or redistribution to other areas. In the larger ports, fish are (1) auctioned to wholesalers, who sell directly to retailers, (2) sold at agreed price to secondary wholesalers, or (3) sold on consignment to secondary wholesalers who act only as consignees.

Fresh fish is efficiently transported from ports to large cities in refrigerated railroad cars. Redistribution is poorly organized. Refrigerated trucks are being used more extensively for both short and long-distance hauls. Marketing has also been hampered by the tendency of retailers to resist receiving lower profits on volume sales. They prefer low volume and high mark-up.

FOREIGN TRADE

France is a net importer of fishery products. In 1966, she imported 199,000 metric tons of edible fishery products worth over US\$180 million. This continues the upward trend of recent years. The imports are 38 percent in fresh and frozen form, 35 percent shellfish, 19 percent canned fish, and 8 percent cured. All have increased since 1961, especially fresh and frozen fish and shellfish.

The Netherlands is the largest seller; Ireland, Morocco, and Norway also sell much. The U. S. is not a large supplier.

Imports of fish oil and meal increased from 96,000 tons in 1961 to 125,000 tons in 1966. Most fish meal and oil originates in Norway; Peru also is an important supplier. French production of fish meal and oil is limited, so imports are necessary.

Exports

Exports have been rising since 1963, when only 35,000 tons were shipped. In 1966, over 60,000 tons of fishery products were sold abroad. Dried, salted, or smoked fish are

the primary exports, mostly salt-cod. The amount of cured fish exported in recent years has been declining. Exports of fresh and frozen fishery products have quadrupled since 1963, and now are almost as important as cured fish. Together, these two categories account for over two-thirds of exports. Italy, Belgium, Luxembourg, West Germany, the Netherlands, and the U. S. are primary markets.

GOVERNMENT ACTIVITIES

The principal fishery agency in France is the Division of Marine Fisheries in the General Secretariat for the Merchant Navy, Ministry of Public Works and Transport. The Division has 2 main subdivisions: management and administration of shellfish culture, and economics of marine fisheries. Other bodies are the Scientific and Technical Institute of Sea Fishing, the Credit Maritime Mutuel, and an advisory body, the Central Committee for Sea Fishing. Their services relate to scientific and technical research, inspection, educational and training facilities, fish promotion, collection of statistics, and economic studies.

In 1965, the Government created a new organization: "FROM" (Fonds Regional d'Organisation du Marche) in northern France, principally covering the ports of Etaples, Boulogne, Fecamp, and Dieppe. FROM was to stabilize catch, avoid market saturation, and improve quality control. FROM's success won it supervision, in 1966, over western and southern ports.

Government activities touch all segments of the industry. The main emphasis is on development and modernization of the fleet. Programs include loans, interest rebates, and subsidies for vessel construction and updating equipment. Many programs are administered by the Credit Maritime Mutuel. Special "incentive" subsidies are provided to encourage use of modern features, such as stern trawls and onboard freezing equipment.

In the Fifth Plan (1966-1970), the government has pledged to: (1) increase landings, (2) improve quality of fish landed, and (3) increase exploitation of previously unutilized or underutilized species. Also, in 1966, a comprehensive expansion program was announced. Its aims were to modernize vessels and equipment, improve shore facilities, increase training facilities, intensify

France (Contd.):

research activities, and increase fish consumption. Financial programs, such as special credit arrangements and subsidies, are included. The main effort will be to increase consumption.

SUMMARY AND OUTLOOK

In 1966, landings of fish and shellfish reached record level of 804,800 metric tons. Landings are expected to continue upward. However, some change in overall catch composition is likely. Several important resources, cod and herring particularly, seem less abundant. Certain fishing areas are being closed to the French as other nations expand fishing limit claims. (France has a 12-mile fisheries limit).

Counteracting these difficulties, however, is the concerted effort by government and industry to construct a more modern fleet. The fleet will be capable of fishing stocks and areas not utilized much--and freezing or processing catches onboard. There is also an effort to modernize the entire industry.

The low per capita consumption rate of about 13 kilos is receiving much attention. The development of a market for frozen fishery products is the key to increased consumption. However, new products and species also will be introduced. The shellfish market has been developing rapidly.

Little major change is likely in the industry's foreign trade position. France is overwhelmingly a net importer.

Government programs have aided industry development. Primary emphasis has been on upgrading the fleet and its equipment. This will continue. Secondary emphasis is on expanding the domestic market.

* * *

FISHING FLEET DECLINES

As of Jan. 1, 1968, the census of the French fishing fleet carried out by the Secretariat of the Merchant Marine showed: 13,770 vessels, a tonnage of 284,110, and 928,780 hp. The fleet is decreasing. The count was 236 units and 2,893 tons less than a year earlier. No doubt there will be another drop by the end of 1968.

Makeup of Fleet

Fleet distribution is: (1) 23 deep-sea trawlers (2 less); (2) 1,411 "fresh fish" trawlers, probably means without freezer (86 fewer); (3) 54 tuna vessels (3 fewer); (4) 4 sardine freezers; (5) 35 tuna freezers (2 less); (6) 100 "fresh fish" or live-bait tuna boats; (7) 34 lobster freezers (3 fewer); (8) 88 lobster boats (3 less); (9) 1,956 multi-purpose vessels (116 more). ("La Peche Maritime," Apr. 1968.)

* * *

DEVELOPMENTS IN TUNA VESSELS

Barely 20 years ago, the major part of the French tuna fleet was sailing boats. Since then, vessels have been developed for live-bait and purse-seine fishing. They have become larger. Orders for twelve 155- and 165-foot vessels were placed within the last 2 years. A dozen will be provided for Saint-Jean-de-Luz and Concarneau (7 for the latter).

Important Development

The Concarneau vessels represent an investment of US\$6.6 million. Incontestably, they mark a new and important stage in the evolution of tuna fishing. They will increase especially the possibility of catching 10,000 to 15,000 metric tons of fish a year. The best profit-earning capacity of a 155-foot tuna vessel is in the 1,500-2,000-ton annual catch. ("La Peche Maritime," Apr. 1968.)



Greece

THE FISHERIES OF GREECE

In 1967, total production from the sea, lakes, and lagoons was 102,317 metric tons. In 1966, it had been 108,082; in 1965, 106,573. This information comes from industry sources and was reported and discussed in the Greek magazine "Alieia," in Feb. 1968.

The reduction was due to the general decline in territorial waters (in Greek seas and lakes because of natural reasons). There was an increase in Mediterranean and over-seas catch.

Greece (Contd.):

	Metric Tons		% Difference
	1967	1966	
1) Atlantic fishing	31,817	29,582	+ 7.55
2) Mediterranean fishing and other-than-Greek waters	4,000	3,500	+14.35
3) Midwater fishing	42,000	47,000	-10.64
4) Coastal fishing	14,000	16,000	-12.50
5) Inland water fishing	10,500	12,000	-12.50
Totals	102,317	108,082	- 5.35

Atlantic Fishing

The overseas catch increased by 2,235 tons, 7.55%, between 1966 and 1967. Between 1965 and 1966, it was 2,509 tons, 9.2%.

Mediterranean Fishing

Despite the 14.35% increase in Mediterranean catch--due to more trawlers in Libyan waters--the catch per trawler unit dropped.

Midwater Fishing

In 1967, there was a remarkable decrease from the 1966 catch of purse seiners and trawlers in Greek waters. The 5,000-ton drop, 10.64%, was due to natural causes. The purse seiners did not fish satisfactorily. Only good catches and prices for mackerel prevented greater losses.

Frozen Fish Consumption

In March and April 1968, Alieia reported figures released by the Union of Greek Atlantic fishing shipowners showing 1967 consumption of frozen fish as 31,826 tons. This was a 10.46% reduction from 1966.

The reduction was due partly to the dissolution, for financial reasons, of distribution companies founded by fishing firms to sell their catches. As a direct result, the trading of frozen fish has been taken over by inde-



Fig. 1 - Fleet near Piraeus, Athens' port. (Photo: FAO/H. Menjaud)

Greece (Contd.):



Fig. 2 - Fishing in main canal of modern irrigation system in Serres Valley in Northern Greece. (Photo: FAO/A. Defever)

pendent provincial transporters. The quality and good appearance of the frozen fish have not been maintained.

A second reason was the indifference of independent traders who made small profit on frozen fish. This has made transporters of frozen products turn towards frozen meat and chicken, which offer a high commission.

Processed Fishery Products

The U. S. Embassy reports that Greek processed fishery products include canned fish, salted fish, sea sponges, and fishmeals.

The fish-canning industry consists of only one small factory, the Pelican Co. in Thessaloniki. It also cans vegetables. Pelican's canned-fish output was:

	1967	1966
	.. (Metric Tons) ..	
Mackerel (salmon-type)	35	31
Sardines (in sauce, in oil)	-	16
Octopus	1	25
Total	36	72

The decrease in canned-fish production probably results from foreign competition in the Greek market.

Fish Salting

This is done in many small, unmechanized, establishments in coastal localities--chiefly Cavala, Thessaloniki, Volos, and on islands of

Euboea and Mitylene. The Directorate of Fishing, Ministry of Industry, has estimated 1967 salted-fish production at 4,000 tons, the same as in 1966.

Sea Sponges

These are Greece's principal processed fishery export product. Sponge production in 1967 was 62 tons, compared with 54 tons in 1966. Sponge fishing occurred in Greek and Libyan waters.

Fishmeals

Production of fishmeals began in late 1965. In 1967, it amounted to 387 tons, compared with 714 tons in 1966. Some owners have decided it is presently uneconomical to produce fishmeals on board their fish factory vessels.

Construction of Fish Markets

The fish markets in Piraeus, Thessaloniki, Patras, Chalkis, and Cavala have been built. Work on the one at Volos is still delayed. The equipment for Patras was obtained from France.

Governmental Activities

A corporation, "ELYPAL," has been established by the Hellenic Industrial Development Bank (ETVA) to organize production and marketing of deep-sea catch. Eventually, it will set up facilities to process fish and fish byproducts. Reportedly, the Ministry of Industry considers assigning management of the fish markets to this corporation, rather than to the Agricultural Bank of Greece, as originally planned. The capital of the corporation is 20,000,000 drachmas (\$667,000: 30 Drs. = US\$1) and 49% of share capital is open to subscription by owners of deep-sea fishing vessels. The deep-sea catch increased from 1,360 tons in 1956 to 32,000 tons in 1967.

1967 Foreign Trade

Greek exports of fishery products, except sponges, totaled 2,476 tons (\$1,454,733) in 1967, compared with 1,954 tons (\$1,326,200) in 1966. The difference was due chiefly to increased exports of frozen and salted fish. Exports to the U. S. included: salted sardines 32 tons (\$13,166), and canned fish 7 tons (\$11,200). Sponge exports were 80 tons worth \$2,262,500 (78 tons were bleached or otherwise processed), compared with 102 tons (\$2,591,000) in 1966. In 1967, the U. S. was

Greece (Contd.):

the principal buyer of sea sponges (27 tons, \$850,700).

1967 Imports

Greece imported 47,304 tons of fishery products worth \$15.2 million, compared with 40,620 tons valued at \$13.2 million in 1966. Imports included: fresh, frozen and salted fish, 17,010 tons (\$6.7 million); canned fish, 12,395 tons (\$5.3 million); sea sponges, 27 tons (\$476,900); and fish and meat meals, 17,872 tons (\$2.7 million).

Imports from the U. S. included: canned fish 3,810 tons (\$1,095,000) of which, 3,790 tons (\$1,054,800) were squids; 9 tons (\$16,100) shrimps; and 3 tons (\$8,000) crabs.



USSR

SOVIETS PROTEST JAPANESE FISHING OFF KAMCHATKA

The Soviet Government organ "Izvestia" has published a special correspondent's article stating that the fishing industry in Kamchatka is being threatened with extinction by "piratical fishing techniques" used by Japanese fishermen. The correspondent had spent a day in the radio station of the Main Administration of the Far Eastern Fisheries listening to reports from Soviet resource-management agents aboard surveillance planes. The agents had given numbers and positions of Japanese vessels.

Following these reports, telegrams from fishery kolkhozes (collective enterprises) were received protesting Japanese fishing of spawning herring off Kamchatka's coast. These telegrams cited woes of local fishermen "for whom fishing is the main source of income." The fishermen did not fulfill the 1967 catch quotas because "no herring came to the spawning grounds."

Japanese Vessels Detained

Several Japanese vessels were caught in Soviet territorial waters (12 miles) and detained. When fishery inspectors boarded them, they found "herring which was just spawning or had just spawned."

Party and fishermen's organizations vigorously protested Japanese methods. They demanded that the Government stop them. ("Izvestia," May 24.)

* * *

'VITIAZ' COMPLETES CENTRAL PACIFIC RESEARCH

The Soviet 2,975-gross-ton research vessel Vitiaz completed a 4-month cruise in mid-May (her 43rd exploration) and returned to Vladivostok. The expedition to the Central Pacific was headed by P. Bezrukov.

Research involved hydrogeology, geophysics, hydrochemistry, and biology. The results will be useful to science, navigation, and fisheries.

Made Port Calls

The Vitiaz made port calls at the Fiji, Samoa, Tonga, and Society Islands (Tahiti), and in Hawaii and Japan. In Tokyo, the Soviet scientists met with Japanese oceanographers and exchanged information. ("Vodnii Transport," May 9 and 14.)

* * *

FAR EASTERN FISHERIES GROUP PUSHES TO FULFIL 5-YEAR PLAN

When the current 5-year plan ends in 1970, the Soviet Union's Far-Eastern Fisheries Administration is scheduled to achieve an annual catch of over 3 million metric tons of fish and other marine products. This would be 800,000 tons above 1967. To reach this goal, it is necessary to discover and exploit new fishing grounds, expand deep-sea fishing, and develop and introduce new equipment and technology.

New Fisheries

The Far-Eastern industry has expanded into fishing for herring, saury, Pacific hake, and mackerel. Mackerel is the latest species to be caught in the Pacific by the Soviets on a commercial scale. Aerial spotting is widely used in this operation. Herring and saury are caught in drift nets, purse seines, and by pair trawling; in the Pacific hake fishery, midwater and pair trawling is used.

The Soviet Pacific tuna fleet is experimenting with a special synthetic bait. It has yielded catches exceeding 3 metric tons.

USSR (Contd.):

Pelagic Midwater Trawling

The expansion program of Soviet Pacific fisheries is based primarily on pelagic midwater trawling. A successful development of this technique requires equipping trawlers with reliable echo-sounders and fish-finders. Important midwater trawling experiments were performed in 1967 by the freezer stern trawler "Kalisto" ("Tropik" class, 2,600 gross tons). The results were recommended for adoption by the entire Soviet Far Eastern fishing fleet.

Purse Seining Developments

To increase purse seining's potential, power blocks have been installed on seiners. Specialists are now working to automate such cumbersome operations as stacking and drying seines as another step toward complete automation of purse seining. They also are studying and designing improved models of fish pumps.

Most Soviet seiners in the Far East belong to the RS-300 class (158 gross tons). They are inadequate for deep-sea fishing. Designing and building special high-seas trawler-seiners is lagging. The obvious solution is to re-equip the available trawlers for deep-sea purse seining. Drift-net fishing also is being automated gradually: vessels are fitted with machines for drift-net handling and shaking, and for fish salting.

Other New Techniques

Other techniques include fishing with lights for herring by Sakhalin fishermen. Catches range between 1 and 5 metric tons per haul. The exploratory refrigerated medium trawler "Yu. Gagarin" ("Okean"-class, 700 gross tons) caught nearly 1.4 metric tons of saury in about 40 minutes by combining light fishing with pump fishing. The fish pump was switched on 26 times, each suction lasting 1.5 minutes. Automatic winches and mechanical devices developed by TINRO specialists for automated squid fishing have been successfully tested. They are now recommended for widespread application.

Other Problems to Solve

Among the problems the Far Eastern Fisheries Administration plans to solve in 1968 are automation of long-lining for bottom fish;

transshipment of catches in detachable containers to floating bases and processing refrigerator vessels; crab fishing with special traps; and others. ("Vodnyi Transport," May 30.)

* * *

EXPANDS POLAR FISHERIES

The Kola Peninsula lies far beyond the Polar Circle. Half a century ago, it was one of the Soviet Union's most backward regions. Today it is becoming an important economic, industrial, and cultural center of the Northern Regions of European USSR. Under the Soviet regime, the economic potential of the Kola Peninsula reportedly has increased up to 370 times.

Fisheries are the oldest economic activity there. Since a trawler base was established at Murmansk 40 years ago, Soviet fishermen have caught a total of about 13 million metric tons of cod, herring, ocean perch, and other species in the North Atlantic, the White and Barents Seas. More than half that catch (7 million tons) was landed during the past decade. The 1967 catch was the highest in the history of Murmansk fisheries. Preliminary estimates place it close to 900,000 metric tons.

Plans for Murmansk

Scientists of the Kola Branch of the USSR Academy of Sciences have worked out economic plans for the region for 1971-1980. These envisage an increase of about 50 percent for the Murmansk fishing industry. The catch is to rise to 1.1 million metric tons by 1970, and to 1.5-1.6 million metric tons by 1980.

The planned expansion of the Murmansk fishing industry faces many problems requiring prompt solution. One is adjusting wholesale prices for fishery products on the basis of actual labor and production expenditures. This is essential for applying successfully the new planning and economic system for fisheries. Another problem is manpower resources. A third is that scientists of the many research institutes must design machinery and equipment specifically for Arctic use. ("Ekonomicheskaya Gazeta," No. 16, April.)

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USSR (Contd.):

FLOATING FISH MARKET WILL COME TO ROSTOV-ON-THE-DON

The Soviet Ministry of Merchant Marine will build a floating fish market on the waterfront of Rostov-on-the-Don. The project is being handled by the Ministry's Central Design and Building Office at Rostov and will promote fish sales and increase consumption.

The market will be supplied by ten ponds capable of holding 15 metric tons of live fish. The public will be able to select their fish from the ponds.

It will be possible to move the floating market to the ponds to load freshly caught fish. ("Vodnyi Transport," June 7.)

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PLANS 1968-70 AZOV-BLACK SEA FISHERIES EXPANSION

The Soviet Azov-Black Sea Fisheries Administration plans to expand deep-sea fishing in 1968-70. However, fishing in the Azov and Black Seas will not be curtailed. In 1967-68, about 63 percent of the Administration's catch was marine fish; by 1970, this share will rise to about 80 percent. The demand for hake, marlin, and other species is constantly growing in Soviet markets. Explorations and surveys are planned to discover new fishing grounds in the Southwest Atlantic and the Indian and Antarctic oceans.

New Vessels & New Techniques

During the first months of 1968, the Administration's high-seas fishing fleet increased by 20 units. It consists of the "Atlantik"-class stern trawlers, "Rembrandt"-class processing refrigerators, and medium trawlers of other classes. Techniques that are being introduced and developed include trawling at 1,640 to 3,280 feet, purse seining, fishing with artificial light sources, and others. Over 30 vessels of the Odessa, Kerch, Sevastopol, and Novorossiisk oceanic fisheries are operating in the Atlantic.

Problem of Ship Repair

A serious problem facing the Administration is ship repair. In 1967, its vessels were laid up for a total of 1,638 vessel-days. The

minimum catch loss to industry is estimated at 33,350 metric tons. This situation is being remedied by more careful handling of vessel equipment, and by crews repairing their own vessels. ("Vodnyi Transport," May 16.)

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WHALING FLEET VISITS AUSTRALIA

A Soviet whaling fleet of 1 factoryship and 20 catcher boats arrived in Sydney, Australia, on May 20, 1968, for a 6-day visit. This was the first shore leave for the crew since the fleet left Vladivostok in September 1967 for the Antarctic whaling grounds. Captain G. V. Vayner, fleet commander, informed the harbor master at Sydney that his vessels required neither oil nor water. Apparently, they had bunkered at sea. Under the Commonwealth Whaling Act, the whaling vessels of all nations enjoy the privilege of bunkering at Australian ports.

4 Months to Capture Quota

Newspaper accounts said it took the fleet more than 4 months to capture its quota of 3,321 whales this year. This was attributed by some Soviet fishermen to a scarcity of whales. Captain Vayner, however, blamed bad weather and rough seas.

Nine fleets hunted whales in the Antarctic during the year--3 Soviet, 4 Japanese, and 2 Norwegian.

The Soviet Fleet

The Soviet fleet's factoryship, the 32,000-gross-ton "Sovietskaya Rossia," is one of 2 whaling factoryships designed and built in the Soviet Union at the Nosenko State Shipyard at Nikolaev. The ship is 715 feet long, nearly 100 feet wide, has 3 decks, and a crew of 521, including 50 women. The ship is carrying a full load of 10,822 metric tons of oil for industrial use, and 7,201 tons of oil for human consumption. Each of the 20 catcher boats is in the 850-gross-ton range and is powered by four 1,000 horsepower diesel engines making 17 knots under full power. It has a crew of 31. One catcher boat killed 246 whales, mostly fin and sei whales.

1,200 Crew Members Shop

The Sydney press said A\$250,000 was paid to the 1,200 members of the fleet before they

USSR (Contd.):

came ashore. Inevitably, several stores blossomed with "Russian spoken here" signs. Shopping was brisk. The visit coincided with a "Britain 68" promotion at the David Jones stores. It was an incongruous sight--Soviet fishermen carrying filled David Jones shopping bags lettered "I'm backing Britain" back to their ships. (U. S. Consulate, Sydney, May 24.)



United Kingdom

SHRIMP FARMING MAY BE TRIED

Experiments are now underway in England to determine an economical way of raising shrimp off Yorkshire. This may lead to establishment of a shrimp farm within a few years. Keir Campbell, leader of the experiments, will soon tour Japan, Australia, Philippines, India, Malaysia, Canada, and the U. S. to obtain information on shrimp farming. Plans call for a first year's production of 10 to 40 metric tons. ("Fish Trades Gazette," May 11.)

* * *

LOBSTER FARM PLANNED

A revolutionary idea of increasing lobster stocks on the north and west coasts of Sutherland, in north Scotland, by improving their natural habitat will be tried this summer by ex-naval divers. This unique experiment was thought up by Lieut.-Commander A. J. Futch.

According to the Marine Laboratory of the Department of Agriculture and Fisheries for Scotland, the population of adult lobsters is limited by the availability of underwater cover when they are extremely vulnerable to predators--for example, when they shed their shells.

To Provide Artificial Cover

Futch and a team including 3 former naval divers intend to provide artificial cover in selected areas. This will create lobster farms that can be cropped systematically.

Scientists say the stretch of coast from Dounreay to Ullapool is the largest area of

underfished lobster ground in Scotland. This project also could help other lobster fishermen.

The Pulford Estates, partners in the venture, will help with administration, management, and marketing outlets.

The team of divers will concentrate on shellfish, not only catching and marketing but farming and preservation of stocks. The effect should be to increase the lobster population on the Sutherland coast.



Iceland

FISH IRRADIATION PROJECT BEGINS

Iceland and the International Atomic Energy Agency (IAEA) announced on June 5 a fish-irradiation project the former is undertaking with the U.S., FAO, and IAEA. Iceland will study the application of irradiation to fish preservation.

Experimentation is being undertaken by the Icelandic Fisheries Research Institute, which has been loaned a portable reactor and equipment by the U.S. Atomic Energy Commission. Reactor and equipment arrived in Iceland early in June. The U.S. also is providing expert personnel to help install and operate the equipment.

Only for Research Now

Although Iceland has no present plans to apply irradiation for fish preservation, she is taking part in the experiment for research purposes. She hopes the technique may later prove of economic advantage to her fish industry. (U.S. Embassy, Reykjavik, June 6.)

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INCREASES COD CATCH

The winter cod fishing season, which ended in May, resulted in a 12% larger catch than last year's winter catch. This was achieved despite the very bad weather that hindered fishing in the first months of 1968.

The 1968 catch was about 156,100 metric tons; in 1967, 139,500 tons. Greater attention is being paid this year to the more

Iceland (Contd.):

valuable cod catch (compared with herring). It had declined 18.7% in 1966 and 22.8% in 1967. It is hoped cod catches will recover to the 1966 level--about 339,000 tons. (U.S. Embassy, Reykjavik, May 27.)

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FISH SLUMP HITS

Declining fish catches and falling world prices for her fish exports have brought crisis to Iceland's economy.

The value of fishery-product exports fell 30% in 1967. Fishery products account for over 90% of total exports and comprise about 20% of the national product. Therefore, the decrease in the value of fishery exports has had significant effects on national income and the balance of payments.

Iceland's Market Problems

The government was concerned over 2 factors in fall 1967: 1) Iceland's exclusion from trading arrangements, pending applications by members of the European Free Trade Association (EFTA) for membership in the European Economic Community (EEC, the Common Market). 2) The effects of EFTA and EEC duties on Icelandic exports. These prompted a government decision to explore the feasibility of joining EFTA.

EFTA countries normally account for 40% of Icelandic fishery exports, and EEC countries for 20%. The U.S. usually is the largest single market. Another important market is the USSR.

Iceland's prospective membership in the EFTA might have long-run effects on the competitive position of U.S. exports. The U.S. is now Iceland's leading supplier.

Counteracting Economic Problems

Measures have been taken to counteract the economic problems. These include the 24.6% devaluation of the kronur in November 1967. The measures have been directed towards restoring balance in external payments--while preventing fishery export price drops from causing further contraction in the export industries--and maintaining a

satisfactory level of employment. Industry, particularly fish processing, is being encouraged to reorganize. Capital investment is being maintained at proper levels. Although investment is reduced because of the economic contraction, it will maintain employment and permit completion of major projects expected to help economic development.

Fish Catch Key to GNP

The direction of the Gross National Product (GNP) in 1968 depends on recovery of the fishing catch, particularly white fish, and the direction of export prices, so far disappointing.

The government is paying more attention to prospects for developing new industry as part of the industrial diversification program to lessen Iceland's dependence on the precarious fishing industry.

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GRANTS HERRING PROCESSING AID

Early in May, Iceland authorized the State Herring Board to borrow up to US\$260,000 for leasing vessels to transport herring from distant fishing grounds to shore for salting--or for processing either for meal and oil. This provisional act stemmed from a study made by a committee representing fishermen, fishing vessel owners, and herring salters.

The committee recommended that freighters be leased to carry herring, salted on shipboard, to coastal points for further salting; also, that tankers be leased to transport fresh herring to oil and meal plants for reduction.

Industry Problems

The herring catch has declined in inshore fishing grounds. In summer 1967, it was necessary to fish for herring several hundred miles off the Northeast coast. So it has been impossible to bring herring to shore for salting in fresh-enough condition.

Much herring was salted in October and November--when it was not in the best condition for salting. Some herring went into oil and meal, less valuable than salted products.

Iceland (Contd.):

Price declines in herring oil and meal have made it more important for the herring industry to use more herring for salting than for reduction.

The new provisional act has been welcomed particularly by the herring industry. It had objected to an increase in export levies authorized by the Althing in April on salted herring and other species. Further measures concerning transportation of herring to shore for reduction likely are forthcoming. (U.S. Embassy, Reykjavik, May 27.)



Italy

1967 CATCH LIKE 1966's

In 1967, Italy's total fishery catch, including tuna and oceanic species, from pelagic and coastal fishing was 250,188 metric tons--up 0.5% over 1966.

Total catch by seining ("tonnare" and "tonnarelle") was 2,051.9 tons: 1,948.7 tons of tuna; 11 tons of mackerel; 7.4 tons of swordfish; 11.5 tons of bonito; and 73.3 tons of other species. This was an increase of 103.9% over 1966. ("La Pesca Italiana," May 2.)



New Fishing Charts Available

The British Whitefish Authority sponsored a fact-finding survey to accumulate all available data on the exact positions of wrecks and other obstructions to fishing that litter the principal European fishing grounds. The data are contained in "Kingfisher Charts," available from the Whitefish Authority, Lincoln's Inn Chambers, 2/3 Cursitor St., London E.C. 4, England, or from Kingfisher Charts Ltd., 247 Cleethorpe Rd., Grimsby, Lincs, England. Price: £2 or US\$4.80.



Sunday is big market day at Fiumicino, small fishing port at mouth of Tiber. Most customers come from Rome, about 10 miles away. Catches per boat are small, selection limited, prices high. (Photo: FAO/P. Johnson)

LATIN AMERICA

Costa Rica

PUNTARENAS ON THE PACIFIC

Puntarenas is the only fishing port of any importance on Costa Rica's Pacific Coast. Its splendid harbor has several shrimp packing plants and a fish cannery. The shrimp plants and their trawlers are by far the most important part of the fishing industry. Their exports are principal earners of foreign exchange.



Fig. 1 - One of the newer shrimp trawlers (about 50 feet) in Puntarenas.

The shrimp industries have been the slowest in Central America to modernize. The fleet consists mostly of small unseaworthy craft, and the plants have been backward by any standards. But competition within the local industry and from neighboring countries is bringing rapid change.

Largest Plant U. S. Controlled

The largest shrimp freezing and packing plant is Productos Altamar, Ltds., which is U. S. controlled. In the past 3 years, this plant has been renovated and modernized considerably. It not only packs shrimp for export but produces much shrimp and finfish for the local market.

The newest freezing plant is Frigorificos de Puntarenas, a division of the Borden Company. It is a modern, well-laid-out plant with the latest sorting and freezing equipment. It was slated to be air conditioned completely. The plant is served by 2 company boats and 6 contract trawlers. Two large boats are being built at local boatyards, and more are planned.



Fig. 2 - Shrimp trawler unloading headed seabobs in baskets on dock of Altamar, S. A. Company has largest shrimp-freezing plant in Costa Rica. Cleaned finfish on deck are for domestic market.



Fig. 3 - Frigorificos de Puntarenas, division of Borden Company, newest shrimp plant in Costa Rica. Puntarenas plants are small. Shrimp are sorted by hand, packed in cartons, and taken to a freezing plant.

Compañía Industrial de Mariscos, Ltda., is the largest locally owned shrimp operation. It is expanding considerably. A second freezing and cold storage unit is under construction and mechanical sorters have been ordered. This plant is served by 7 boats; 3 more are being built locally.

Compañía Empacadora del Pacifico, Ltda., is a combination meat and shrimp packing and freezing operation; the emphasis is on meat. Both products are packed for export. All shrimp sorting is done by hand.

Costa Rica (Contd.):

Two or 3 small companies also pack shrimp. One has very limited freezing facilities; the others simply pack the shrimp and have them frozen in the larger plants.

The Shrimp Fleet

The shrimp fleet has about 55 trawlers, including new ones. Several of these modern craft are large enough to operate outside the protected waters of the Gulf of Nicoya; at least 5 more are under construction. So the fleet is becoming more efficient. The government's limit on fleet size is 50 trawlers; presumably, old, inefficient boats will be withdrawn as new vessels are built.

Despite new and better boats and plant facilities, shrimp production has not increased greatly in recent years.

Pacific Coast Shrimp Catch (Heads-Off Weight)				
Production	1964	1965	1966	1967
	. (Thousands of Pounds) .			
White and Brown Shrimp	1,232	582	744	737
Pink Shrimp	172	320	331	548
Sea Bobs, etc.	1,327	1,551	1,406	1,241
Total All Shrimp	2,731	2,453	2,481	2,526
Fish	708	1,355	1,313	1,429
Fishing Effort				
Avg. Number Boats Fishing . . .	42	45	48	48
Total Number Boat-Days of Fishing	8,874	9,094	11,162	n.a.

During 1961-1963, the catches for all species were about the same as for 1964. The exception was white shrimp, which were less than half 1964 production. (The category "white and brown" consists almost entirely of 2 species of very large whites.) Since then, the catch of whites has leveled off at slightly above the pre-1964 level. The fishery's growth depends on expanding catches of pink shrimp, which has been done (see table). The newer and better boats are able to take this species, which is found in deeper water than whites and sea bobs. Landings of finfish by shrimp trawlers have doubled in recent years. Consumers in the capital city of San Jose now have a dependable supply.

Fish Canning

The fish-canning operation at Puntarenas is Compañía Enlatadora Nacional, S.A., owned partly by local interests and partly by resident Americans. Until recently, the plant was used solely for tuna canning; fish meal was produced from the offal. Operations were expanded with the construction of a sardine line.

The cannery owns and operates one live-bait tuna clipper, the "Southern Seas," with a capacity of about 150 tons. Once a U. S. vessel, it now carries Costa Rican registry. Although it engages in fishing at times, it is used principally for transporting tuna bought from freezing plants in Ecuador. Most tuna packed in Puntarenas is supplied by U. S. tuna vessels. These sell all or part of their catches under arrangements between vessel owners and the cannery. Early in 1968, a working agreement was made to pack tuna landed by Del Monte vessels, using the Del Monte label, for sale in Central America. The company's own label, Tesoro del Mar, is sold principally in Costa Rica.



Fig. 4 - Tuna clipper "Southern Seas" is the entire Costa Rican tuna fleet. She fishes live bait sometimes. Used mostly to transport tuna bought in Ecuador. (Photographs and information: R. S. Croker, Regional Fisheries Attaché, U. S. Embassy, Mexico City.)

The cannery installed a sardine packing line for 1-pound oval cans in 1967. The fish used are the 2 species of thread herring found in the Gulf of Nicoya. Production has been very small. The development of sardine canning has been slow because of the inexperience of local fishermen, unsuitability of the one available boat and its gear, the unavailability of domestic tomato sauce, and the alleged poor quality of available cans. When production gets underway, it is planned to take advantage of the large demand for canned sardines in the Central American Common Market.

A tuna freezing plant in Puntarenas goes back to the postwar years. Formerly, it was used for transshipments to U. S. canneries. The machinery and equipment have been sold for nonfishery use and the plant is being dismantled.

A group of Puntarenas businessmen, headed by Roberto and Eduardo Beeche, is interested in obtaining U. S. capital to build a tuna cannery. The group believes that the potential Central American market far exceeds the limited production of the existing cannery, which operates well below capacity.

Guatemala

EXPLOITATION OF MARINE RESOURCES

Guatemala has 402 km. of coastline, 255 km. on the Pacific Ocean, the remainder on the Atlantic. There is a small, growing commercial fisheries industry on the Pacific Coast. There is almost no commercial exploitation of fishing resources on the Atlantic Coast and none is foreseen. This report deals almost exclusively with commercial activity on the Pacific Coast. Subsistence fishing is carried out on both coasts, but it is difficult to assess its importance.

Fish Caught Off Guatemala

The major effort goes to catching shrimp. Other fish and crustaceans and mollusks also are caught for commercial use. The types of shrimp are: *Peneaus stylirostris*; *P. vannamei*; *P. californiensis*; *P. brevisrostris*; *Trachipeneus byrdi*; *T. faoea*; *T. similis pacificus*; and *Ciphoneus ribeti*. The following types of fish are frequently caught in the same nets that capture shrimp (local Spanish names are in parentheses): *Lutjanus griseus colorado* (Pargo); *Epinephalus striatus* (Bosh) (Moro); *Platista vulgaris* (Lenguado); *Centroponus undecimalis* (Robalo); *Huro nigricans* (Bonito); *Mugil lisa* (Lisa); *Albula vulpes* (Raton); *Alectis crotinus* (Palometa); *Cynoscion* spp. (Colbina). Because processing plants are lacking, most fish are returned to the ocean. Among crustaceans frequently caught are: *Loligo vulgaris*, and *Panilurus interruptus* and *inflatus*.

The Local Industry

Tables 1-3 detail recent and projected fish catches, exports, and local consumption. Since 1963, exports of shrimp, fish, crustaceans, and mollusks have averaged about \$2 million annually. Thirty small shrimping boats belong to 3 private companies. Guatemalan law limits each company's ownership to 10 ships.

Product	1963	1964	1965	1969	1974	1984
	(Metric Tons)					
Fish	130	210	242	600	2,000	4,176
Shrimp	905	1,318	897	1,600	1,600	1,600
Crustaceans and Mollusks	19	21	13	50	65	100
Total	1,054	1,550	1,152	2,250	3,665	5,876

Product	1963	1964	1965	1969	1974	1984
	(Metric Tons)					
Fish	-	-	-	-	800	2,176
Shrimp	643	1,010	825	1,400	1,300	1,200
Crustaceans and Mollusks	-	-	-	-	-	-
Total	643	1,010	825	1,400	2,100	3,376

Product	1963	1964	1965	1969	1974	1984
	(Metric Tons)					
Fish	130	210	242	600	1,200	2,000
Shrimp	262	308	72	200	300	400
Crustaceans and Mollusks	19	21	13	50	65	100
Total	411	540	327	850	1,565	2,500

Note: Columns may not add due to rounding.
Source: Director General of Statistics and Ministry of Agriculture.

Of the 30, 20 operate out of Champerico in Retalhuleu Department, southwestern Guatemala; the remainder operate out of Iztapa, adjacent to San Jose in Escuintla Department, south of Guatemala City.

Each shrimp boat averages 2 trips per month to fishing grounds off Guatemala; these trips average about 13 days per month at sea. Ten of these boats are wood, the remainder steel. Each boat is worth about \$65,000. Government officials estimate that each boat can catch roughly 100,000 pounds of shrimp a year.

There are 2 shrimp processing plants. The larger is in Champerico. It has freezing and storage facilities, a processing plant, workshops, etc. A substantially smaller plant began to operate in Iztapa in May 1966.

Guatemala (Contd.):

Fishing Industry Potential

The government estimates that shrimpers are forced to throw back into the ocean roughly 5-10 pounds of fish for each pound of shrimp caught. This is because there are no facilities for processing fish. The government is interested in increasing exploitation of its fishing resources. It plans to construct a Pacific Coast port, which would handle cargo and receive fish. This project will cost about \$15 million. The government is seeking international help to begin construction.

Diet Would Improve

Additional fish-processing facilities must be constructed and the fleet expanded. Presumably, these investments will be made by private enterprise. Fish caught as a result of these new facilities could augment the national diet, extremely deficient in protein. Current consumption is estimated at 600 grams of fish per person per year. Fish is virtually unavailable through commercial channels in most rural areas of Guatemala. With new construction, the fish now caught but thrown back could be frozen or otherwise processed for human consumption, or turned into fish flour. Exports of fish and fish products could be a useful new source of foreign exchange.

Tuna Resources

The government feels that tuna resources off the coast are most promising for large-scale exploitation. The government estimates roughly that about 4,000 to 5,000 metric tons of tuna per year are caught off Guatemala in the area extending 5 degrees of latitude and 5 degrees of longitude off the Pacific Coast.

The projections for increased catches shown in the tables assume construction of a new port, related processing facilities, and more boats.



Haiti

THE SPINY LOBSTER FISHERY

The Haitian annual catch of spiny lobsters during 1963-67 was only slightly larger than total exports, report trade sources. This is because there is little domestic consumption. All exports are frozen and go to the U. S. The 1967 data show imports of 214,000 pounds; however, trade sources report shipments of over 300,000 pounds.

Preparation For Export

Six companies export lobster tails to the U. S. In preparing tails for shipment, the heads are removed. The tails are deveined, cleaned, wrapped in plastic or cellophane, quick-frozen, sized, boxed, and stored at 0° to 5° F. until shipped. Tails are sized according to weight in ounces. The categories are: 2-4, 4-6, 6-8, 8-10, 10-12, 12-14, 16 and over. The U. S. restaurant and hotel industry pays prime prices for the 4-6 and 6-8 oz. sizes.

A 10-lb. pack is standard. The most common practice is to assemble 4 packs in a master carton. Less common is the 60-lb. master carton.

The lobsters are shipped to the U. S. via Grace Lines. Good schedules, reliability, and refrigerated cargo holds have played a large role in the growth of Haiti's spiny lobster tail industry.

Industry's Future

Industry opinion regarding its future is divided. The growing competition for the spiny lobster concerns everyone. Some exporters are pessimistic and defensive. They see their role as holding on to their share of production, while carefully watching production costs.

Others, including the progressive firms, are confident. They foresee opportunities for greatly increasing yields by purchasing modern equipment and adopting advanced fishing practices. Also, they claim, diversified production is possible. They cite the feasibility of large shrimp catches, filleted fish sales, and commercial fish and frog farming.

Haiti (Contd.):

Over 80 percent of the catch is made with conch meat-baited bamboo or wooden traps. The remainder is taken with spear gun. The best fishing is in the waters of the southern peninsula. Boats ply from Port-au-Prince to Jacmel. The Cayes area is consistently the biggest producer.

A slight seasonal variation is evident. The north shore of the southern peninsula produces better in spring and summer, while the southern shore yields more in fall and winter.

The Agents

Most exporters have established relationships with agents, known locally as "speculators," throughout the southern peninsula's coastal settlements. The speculators pay fishermen \$0.60 to \$0.80/lb. for the tails. The fishermen's weekly catches average 40 to 60 lbs. Against this catch, the speculator often makes a small cash advance. He also provides fishermen with styrofoam ice chests and ice to store their catches.

Most exporting firms own 2 or 3 boats that sail the coastal waters. Routinely, they call on speculators and take on their shipments. The speculators add \$0.10 to \$0.15/lb. when selling to the exporter. If the speculator delivers his tails to the exporter in Port-au-Prince, he gets \$1.15 to \$1.30/lb. All tails eventually reach Port-au-Prince. There the exporters maintain their own freezing and storage equipment. The meat is highly perishable, so all must be done quickly.

Speculators are paying ever-higher prices to hold on to their client fishermen, while trying to attract their rivals' fishermen. The result is that exporters must pay more per pound for the tails--and have to sell them in a market where fairly stabilized prices have existed for nearly 3 years.

Exporters Also Deal With Fishermen

Some exporters also deal directly with fishermen, supplanting the speculator. Exporters have even provided outboard motors to client fishermen to increase production. The experiment has been successful because fishermen prefer to make the most of their leisure time rather than their catch. Lacking mechanical sophistication, they tend to abuse the machines.

Two exporting firms fish to supplement their purchases, and a third is preparing to do it. To maintain a coterie of client fishermen, the exporter buys all or some of their catch of fish, conch, and shrimp. The fish are sold either locally or find their way to the Port-au-Prince market. Insignificant amounts of conch meat and shrimp have been exported to the U. S. Little demand apparently exists for the former, while too few shrimp are caught to support an export industry. An attempt is about to be made by 2 firms to increase shrimp production by using modern equipment. (U. S. Embassy, Port-au-Prince, May 24.)



Guyana

SHRIMP INDUSTRY HALTED BY LABOR DISPUTE

Shrimp fishing in Guyana has been halted by a dispute between vessel captains and owners of shrimp companies and vessels. The captains, U. S. citizens, demand that the National Maritime Union be recognized as their bargaining agent in dealings with owners. The companies, U. S.-owned, have rejected the demands and threatened to close their Guyana plants. The stalemate continues.

Shrimp Industry

Guyana, the former British colony of British Guiana, is on the northeast coast of South America, east of Venezuela. The population is 650,000. Major industries are agriculture and mining.

The shrimp industry, a major earner of foreign exchange, employs about 800 Guyanese. In 1967, Guyana exported to the U. S. about 9,500,000 pounds of shrimp worth US\$7,400,000 (nearly one-third of all shrimp exports to U. S. from South America). The Government obtains about US\$500,000 annually in taxes and export revenues, and reportedly millions more in wages, local purchases, and similar expenditures.

The Fleet

The fleet numbers about 130-150 vessels. Basically, it is foreign-owned, the bulk con-

Guyana (Contd.):

trolled by U. S. interests. Vessels usually are skippered by U. S. captains; the crews (usually 3 men) are Guyanese. (St. Petersburg "Evening Independent," June 12; Dept. of State.)

* * *

SHRIMP INSPECTION

Two packing plants prepare shrimp for export to the U. S. One is owned by Georgetown Seafoods Co., the other by Guyana Industrial Holdings. Shrimp are caught mostly by U. S.-registered trawlers. Trawlers and packing plants, alert to improvements, appear to be operating under adequate sanitary and quality controls.

Sanitary Regulations At Sea

The following sanitary regulations are generally observed in shrimp processing. After discharging shrimp, trawlers are scrubbed with detergent and nontoxic disinfectant. Concrete holds, built in most trawlers, are easily cleaned. Georgetown Seafoods cleans its trawlers a second time before sending them to sea.

At sea, shrimp are stored on fresh ice under mechanical refrigeration; they are usually stored 7 to 10 days.

Plant Sanitation

When shrimp are unloaded, they are moved by conveyors from dock to adjacent packing plants. Plants use chlorinated water. All machinery, scales, work tables, and floors are washed with water and sprayed with disinfectant at least once a day. Blast-freezing rooms have a capacity to chill from -60° F. (Georgetown Seafoods) to -35° F. (Guyana Industrial Holdings). Storage rooms in both plants can reach a minimum temperature of -20° F.

Workers wear uniforms, rubber gloves, boots, and headgear. Workers are required to rinse their hands with a disinfectant after using toilet facilities.

Plants are inspected periodically by a government team for sanitation and proper refrigeration.

Quality Control

The following quality-control standards are generally observed: Workers on inspection belt (6 at Georgetown Seafoods, 8 at Guyana Industrial Holdings) separate out broken and blemished shrimp. Every 10th package is spot-checked at Georgetown Seafoods.

The following steps are being taken to increase sanitation and quality control: Guyana Industrial Holdings plans to: (a) buy a high-power water pump to scrub trawler holds more effectively, (b) buy booster for blast freezer to lower temperatures to -40° F. Georgetown Seafoods operates an improve-as-you-go plan to raise performance of workers and to increase product quality. (U. S. Embassy, Georgetown, Mar. 13.)



Peru

FISH MEAL PRODUCTION SET RECORD IN EARLY 1968

The 1967/68 Peruvian anchovy fishing season closed May 31 after producing 9.5 million metric tons. Production of anchovy meal continued at record levels during early 1968. The larger-than-expected rise reflected the Government's increase of the 1967/68 anchovy catch limit from 8 to 9.5 million metric tons. Fishing conditions continued favorable through May.

Despite the Feb. 17-Mar. 16 "veda," or closed season, the Jan.-May production was 34,556 tons above the 1967 period. However, exports of 888,706 tons during the same 5-month period sharply exceeded the 610,350 tons exported during the year-earlier period. Stocks remained high. On June 1, 1968, 727,916 tons were on hand compared to 751,636 tons at the same time in 1967. Production during the 1968/69 season will depend heavily on the level of the anchovy catch limit imposed. A slightly higher extraction rate, however, would tend to increase production if more plants use evaporator equipment. This equipment improves the recovery of soluble solids. The Government passed a law on June 20 exempting imports of stickwater plants from certain customs duties for 3 years.

Peru (Contd.):

Bulk shipments of fish meal were initiated in 1963. They dropped, then resumed this year and could exceed 100,000 tons by year end. The move toward pelletized bulk meal reportedly could reduce costs by US\$7 a ton. ("World Agriculture and Trade," U. S. Dept. of Agriculture, June 1968; U. S. Embassy, Lima, July 2.)

Fish Meal Stocks

Stocks of fish meal on May 31, 1968, were at a record seasonal level of 727,916 tons, compared with 712,506 on April 30 and 714,578 on April 15.

On May 31, 138 fish meal plants were operating, 53 others had closed, 8 had been dismantled, and 1 had moved.

Fish Meal Exports

Total fish meal exports for Jan.-May 1968 were the highest in several years: 1967--610,350 tons; 1966--626,744 tons; 1965--785,817 tons.

Country of Destination	Metric Tons
Crude:	
West Germany	24,346
Denmark	4,719
Ecuador	800
Netherlands	52,530
Norway	3,017
Total	85,412
Semi-Refined:	
West Germany	12,293
Colombia	7,776
Denmark	5,627
Ecuador	779
Netherlands	61,277
U. K.	1,184
Total	89,936



AMMONIA FOR SPEEDY PRESERVATION OF FISH

Liquid or gaseous ammonia may solve an ancient problem of keeping fish from spoiling in the tropics.

A quick and easy treatment of immersing sardines in ammonia has preserved fish for more than two months without deterioration of their nutritive value. Using the ammonia treatment soon after fish are caught allows bulk storage at ordinary temperatures.

In many parts of the world, large catches of good edible fish become available during short seasons.

When facilities for cold storage are inadequate, spoilage is extensive and valuable food is wasted. In the tropics, fish spoilage starts within a few hours after the catch.

The safe, speedy method of immersing the fish, in particular sardines, in ammonia solution for about one to two hours and then transferring to an air-tight vessel preserved fish for months in excellent condition, the scientists found. Temperatures were kept at about 77 to 86 degrees Fahrenheit.

Ammonia is a colorless gaseous compound of nitrogen and hydrogen with an extremely pungent smell and taste. As the fish is dried and processed into fish flour, the ammonia is removed and the preserved fish is free from pathogens and has a low bacterial count.

There is no measurable residue of ammonia in the final product, report V. Subrahmanyam, N. L. Lahiry, M. N. Moorjani, R. Balakrishnan Nair and M. A. Krishnaswamy from the Central Food Technological Research Institute in Mysore, India. (Reprinted, with permission from "Science News," weekly summary of current science, copyright 1966, by Science Service, Inc.).

ASIA

Philippines

THE FISHING INDUSTRY

The Philippine Fisheries Commission reported that fish production in 1966 was only 5.7 percent above 1965. This increase does not meet the needs of a growing population and the increased consumption of fish. Imports of canned fish and fishery products dropped slightly in 1966. The Philippines imported 50.1 million kilograms of fish and fishery products worth ₱59.5 million (3.9 pesos equal US\$1).

The major import was canned mackerel. The share of the Philippine market for U. S. fishery products in 1966 was about the same as in 1965: ₱2.3 million. In 1966, the Philippines exported ₱4.9 million in fishery products, a substantial increase from 1965's ₱2.8.

Problem-Plagued Industry

As a result of high operating costs and lack of fish for canning, the White Rose Fish Cannery was not able to begin operation. Negotiations were underway to sell the cannery to a firm in Kuwait for installation there.

The industry continues to be plagued by government neglect, lack of capital and refrigeration facilities, and a poor distribution system. In 1968, President Ferdinand Marcos requested the Fisheries Commission to prepare a detailed plan to increase fish production. The President stated he intended to give the same emphasis to increasing fish production as he had to his successful program to increase rice production. Some observers wonder whether the government will devote enough of its scarce resources to achieve a major increase in fish production.

Production and Consumption

"Fisheries Statistics of the Philippines - 1966" disclosed that in 1966 the Philippines produced 705,278,000 kilograms of fishery products worth ₱825,988,000. In 1965, the Philippines produced 667,202,000 kilograms of fishery products worth ₱806,509,000.

Fish consumption in 1966, exclusive of fish meal, was 746,260,000 kilograms worth ₱878,442,000. Fish consumption in 1965 had



been 709,471,000 kilograms worth ₱862,393,000; per-capita consumption was 22.29 kilograms. Based on the per-capita normal requirement of 26.95 kilograms established by the National Research Food Council of the Philippines in 1959, the fish requirement in 1966 was 1,026,414,000 kilograms. Fish production was 321,136,000 kilograms (31.3 percent) short of this requirement; fish consumption was 280,154,000 kilograms short.

Imports and Exports

In 1966, the Philippines exported 2,573,250 kilograms of fishery products, including shell-craft, worth ₱4,908,357. In 1965, the value had been ₱2,775,564. This major increase resulted from export of fresh fish, mostly to the U. S. In 1966, the Philippines exported 1,063,826 kilograms of fresh fish worth ₱1,849,953, compared with 317,962 kilograms worth ₱335,099 in 1965. In 1966, the Philippines found a new export--seaweeds; ₱461,748

Philippines (Contd.):

worth were exported, mostly to the U. S. There is no prior record of seaweed export.

The export of finished shell buttons worth ₱1,129,423 was slightly below 1965's figure. The export of fresh shrimp increased slightly to ₱197,099; about 40 percent went to the U. S. In 1966, exports to the U. S., including Guam, were ₱3,531,583, about 71 percent of total exports.

Imports

Imports of fish and fishery products decreased slightly in 1966 from 1965. During 1966, the Philippines imported 50,120,327 kilograms of fish and fishery products worth ₱59,508,592. In 1965, 51,730,589 kilograms of fishery products valued at ₱61,692,012 were imported.

Canned mackerel remains the major import. During 1966, 32,019,430 kilograms worth ₱39,808,380 were imported. There was a major decrease in sardine imports in 1966: only ₱4,773,138 worth, compared with ₱15,586,768 in 1965. The National Marketing Corporation (NAMARCO) had been the major importer of sardines. In recent years, its imports exceeded the demand. This created a considerable backlog. It was one of the factors leading to President Ferdinand Marcos' decision in 1967 to end all NAMARCO imports.

Imports of sardines from the Union of South Africa dropped to ₱1,995,876 in 1966. This probably resulted from President Marcos' order of May 31, 1966, banning imports of canned fish from South Africa. The share of the Philippine market for U. S. fishery products in 1966 was about the same as 1965--₱2.3 million. Of this amount, ₱1.9 million went for cuttlefish (squid).

Inland Fisheries

In 1966, the fishpond industry produced 63,654,340 kilograms of fish worth ₱129,854,860.

	1965	1966
Area (in hectares)	137,251	138,968
Investment (in pesos) 1/	274,501,360	277,935,260
Men employed 2/	137,250	138,967
Production (in kilograms)	63,197,690	63,654,340
Value of production (in pesos)	106,172,120	129,854,860

1/Based on average developmental cost of ₱2,000 per hectare.

2/Based on average of one man employed to every hectare.

In 1966, the Fisheries Commission estimated there were still 547,340 hectares of swamplands available for fishpond use. These swamplands consisted of 186,688 hectares of fresh-water swamps and 360,650 hectares of mangrove swamps. In 1966, the production per hectare decreased slightly to 458 kilograms. This reflected again the fact that the government has made no progress in its announced plans to increase fishpond production to 2,000 kilograms per hectare. The failure to increase production may be attributed largely to lack of financing, antiquated methods of fishpond culture, lack of experienced personnel and poor management.

President Marcos also had announced plans to add 700,000 hectares to the fishpond industry. At the end of December 1967, Vice President Fernando Lopez, who was in charge of this program, complained that of the 700,000 hectares, only 3,398 hectares had been released for fishponds by the Bureau of Forestry.

Commercial Fishing

The 1966 annual production from commercial fishing operations increased only 14,825,000 kilograms over 1965. Value of the catch actually decreased by ₱5,849,000. There were 2,544 commercial fishing vessels in operation in 1966, an increase of 161 over 1965. Gross tonnage was 70,834 metric tons. In 1966, an estimated 31,026 persons were engaged in commercial fishing; 21,991 of them were licensed.

There has been no noticeable improvement in the commercial fishing industry in the past year. The industry still suffers from government neglect, lack of capital and financing, and lack of refrigeration and berthing facilities.

Fish Processing

Virtually no progress was made in the fish-processing industry during 1967. The White Rose Packing Corp. installed its fish cannery, but it was never put into operation. It was negotiating with Gulf Fisheries of Kuwait to sell the cannery for installation there.

The inability of White Rose to operate the cannery may be attributed to several factors. Firstly, it is more profitable to sell the catch as fresh fish. The demand for fresh fish exceeds supply and White Rose found it was more



Fig. 1 - An "armadahan," 2-mast fishing boat, on Laguna de Bay.



Fig. 2 - Fisherman wears mask against sun as he uses "surambaw," a drive-in-net, in Laguna de Bay.



Fig. 3 - Researchers of Freshwater Fisheries Investigation Unit at Los Banos netting gobies. They seek to preserve fish and small life of Laguna de Bay, 50 miles from Manila; also, to study aquatic insects, map lake, and check pollution.



Fig. 4 - A Philippine fisherman using "Salakab." It is a bamboo cover pot designed to catch "dalag" (small fish) in inland bodies of fresh water. FAO has helped island increase production in inland waters by determining suitable stocking species. (Photos: UN)

Philippines (Contd.):

profitable to sell its catches as fresh fish. Also, the Philippine tariff laws increased the cannery's operating cost to the point where it could not compete with imported canned fish products. The government raised the tariff on imported tinplate to 40 percent (the local product is considered unsatisfactory for canning fish) and tomato paste to 100 percent (the preferred canning sauce).

Government Activity

A proposed congressional bill to create a Fisheries Development Bank did not prosper during the 1967 congressional session. There is little likelihood that the bill will be re-introduced. The bank was to consolidate into one lending agency the power to grant loans to individuals and firms in the fishing industry. There was too much opposition from other lending agencies, such as the Development Bank of the Philippines, which were against losing these clients.

Manila Fishing Port

Construction of a much-needed fishing port at the Manila North Harbor was initiated by the Bureau of Public Works. This project is scheduled to be completed within 3½ years at a cost of P22 million. It will provide 18 berths for unloading of fish catch and another 18 for servicing and bunkering. Thus far, only P2.9 million has been released for the project. The Government will apply for a P10 million loan from the Asian Development Bank; Congress will appropriate the remainder. Currently, the fishing vessels must anchor offshore and have their catch transported by amphibian truck into the major fish-landing center at Navotas, Rizal.

Outlook

A United Nations deepsea fishing expert, assigned to the nation in a joint project with the Philippine Fisheries Commission, said the Philippines could be self sufficient in fish production in 10 years. He assumed there would be improved fishing methods, better equipment, more trained personnel, and better fisheries data.

In 1968, President Marcos instructed the Fisheries Commission to prepare a detailed program to increase fish production. He said he wanted this program to be similar in scope

to the successful rice production program, which resulted in a major increase in production. However, such a program would require much money, either directly by the government or through government lending agencies, for research programs and equipment, piers, refrigeration facilities, fishing boats and related equipment, and fish canneries. It is doubtful whether the nation will be able to devote enough of its scarce resource to conduct the necessary fish-production program.



Indonesia

FISHING OFFERS PROMISE AS FOOD SOURCE

Fishing is one of the most promising parts of Indonesia's food-production situation. The Directorate General of Sea Resources estimates that in the 5.5 million square miles of adjoining seas, there is a potential annual fish harvest of 4.5 million metric tons. This figure does not include such abundant marine products as mollusks, seaweed, pearls and mother-of-pearl.

Like other sectors of production, fisheries development is hampered by shortages of capital and technical competence. Both can be supplied partly by foreign investment. However, observers say, the Indonesians themselves must provide the incentive to fisherman to produce more. Also, they must investigate the social changes required in a transition from subsistence fishing to large-scale fishing.

Marine Fisheries

In 1967, about two-thirds of Indonesia's catch of 1.25 million metric tons of fish came from sea fisheries. These fisheries are generally confined to shallow, protected waters near the coast. The fishermen cannot go farther because they do not have large, motorized seagoing vessels. The catch is reduced because these traditional grounds are slowly being depleted.

There are about 920,000 fishermen in sea fisheries. They operate an estimated 230,000 small fishing craft (hold capacity of two to ten cubic meters). Fewer than 3,500 of these are motorized. The equipment used is primitive: lines and nets are made of native natu-

Indonesia (Contd.):

ral fiber. These small fishermen account for 98 percent of the total sea catch.

Inland Fisheries

The inland fisheries include 3 different types of fishing: (1) freshwater, (2) swamp, and (3) brackish water.

East and Central Java are the centers of freshwater fish raising. Carp is the prime species. It is bred with the care that many Western cattle breeders lavish on their finest stock. Several varieties of the minnow species also are raised in inland ponds. Fish fry are available in local markets and are raised in home fishponds or flooded rice paddies. Inland fishponds produce about 80,000 tons a year.

Fisheries Production			
	1967	1966	1965
	(In Thousand Metric Tons)		
Marine Fisheries	790	721	661
Inland Fisheries	465	400	370
Total	1,255	1,121	1,031

Source: Directorate General for Marine Resources.

Many varieties are caught by primitive methods in the swamp areas of Sumatra and Kalimantan. The total catch is estimated at 330,000 tons annually. The yields fluctuate greatly depending on amount and timing of rainfall.

The raising of fish and prawns in brackish-water ponds is centered in East Java. Milkfish is the principal species. An estimated 56,000 tons were produced in 1967. The ponds usually are areas reclaimed from mangrove swamps. There is heavy demand for milkfish. It is the shortage of development capital primarily that prevents reclaiming more of the over 6,000,000 hectares covered by mangrove swamps in Indonesia. Presently, the brackishwater pond area is only 140,000 hectares.

Fish Processing

Fish processing is primitive. Only about 10,000 tons of the total fish product is processed by modern canning techniques; the remainder is sun-dried, salted, or ground into meal. The latter methods are used in thousands of small operations and statistics on the total processed product are not available.

If modern equipment and techniques were introduced, there would be a real possibility of a fish surplus. So it is important that steps be taken to rehabilitate and expand the fish-processing industry. Much can be accomplished through agreements with foreign investors--concession grants stipulating that freezing plants, storage facilities, and other on-shore installations be constructed by the investor. Some effort will be needed to cultivate a domestic market for processed fish products once they become available. It is possible that modern techniques could be applied to processing popular, traditional, fish-based food, particularly meal and wafers, which would have the advantage of a ready-made market.

Fishery Problems

The shortage of capital for development purposes is the all-embracing problem. It hampers entry into deep-water fishing, prevents rehabilitation of more swamp area for brackishwater fisheries, and slows development of a fish-marketing operation.

Besides the requisites to catch fish, the industry needs better transportation, preservation, and processing sectors. Getting fish from the sea, swamp, or pond is only half the problem. The most difficult--and most neglected part--is getting the product to a local or world market in saleable condition.

Efforts to develop fishing's full potential are stymied by the fisherman's lack of training and education. The fisherman also must be provided equipment on terms he can afford (hire-purchase schemes). The fisherman reacts like the peasant farmer against attempts to introduce new techniques.

Foreign Investment

The few surveys made indicated that high-seas fisheries contain enough wealth to justify exploiting them. Most products are of great export value, considering Indonesia's perpetual foreign-exchange shortage. Particularly notable are abundant tunas (yellowfin, skipjack, and bonito) and shrimp. Shrimp also has a high value domestically.

Companies of at least 7 countries are interested in entering Indonesian high-seas fisheries. Several agreements have been signed; most are still negotiating. Two have received final government approval and are surveying.

Indonesia (Contd.):

One approved is the Shin Hung Refrigeration Co. of South Korea. It is involved in a joint shrimping venture with Nusantara Djaja Trading Co. off South Java. From the outset, Shin Hung's survey operations have met opposition from local fishing and certain military circles. Fishermen around Tjilitjap, the Shin Hung base, strongly protested alleged "theft of catch" and fouling of nets by the South Koreans. The local navy garrison insinuated that the Koreans were there only to spy on coastal defenses. These allegations have been made less frequently in recent months. This is due probably to the Maritime Ministry's demand that the Korean fleet stay at least 6 miles from the coast.

The Tjilitjap fishermen may have had some justification for the "we wuz robbed" attitude. Though cast in terms of a survey, the Korean nets were capturing over 300 tons of shrimp per month; all would have been marketable at handsome prices within Indonesia and abroad. Furthermore, a refrigerator vessel from Shin Hung is scheduled to be dispatched to Indonesian waters. In view of Indonesian emphasis on on-shore installations, the welcome for the refrigerator craft may not be cordial.

The other fleet already active is from Gulf Fisheries of Kuwait. It is operating in a joint venture with the Indonesian firm P. T. Minipaya. It is taking shrimp and lobster in the Straits of Malacca. A contract was signed Feb. 10, 1968, calling for a 10-year concession, which includes one year for survey.

A third joint venture has received government approval but has not yet been implemented. It is between A. S. Nor Kar of Norway and C. V. Bonito of Indonesia, to operate as partners off the North Central Sulawesi (Celebes) coast. It covers a 15-year period, with one year marked for surveys.

Many potential foreign investors, including Americans, have indicated interest in beginning Indonesian operations as import agents before proceeding with full-scale investment. They are interested particularly in shrimp; its price is sufficiently high to provide good profits. If profit prospects (and the political picture) indicate that investment is worth the risk, there may be a major influx of these individuals as investors in the next few years.

Japanese Investments

Many factors, including the size of Japan's 1968 aid package to Indonesia, enter into the discussion of Japanese fishing activities, or absence, in Indonesian waters. Indonesia prefers separate agreements with each Japanese company. But Japan has been pushing for a fishing treaty covering all problem areas of contention on a government-to-government basis.

Negotiations toward a fishing agreement have been proceeding since December 1967. All major points have been agreed on, though no announcement of the end of talks has been made. The inclusion or exclusion of Okinawan fishing interests in any Japan-Indonesian agreement is also a factor being discussed.

The Prospects

Production can be raised in all sectors of the industry. Technical assistance is the most important ingredient in increasing output of freshwater ponds. The Land Fisheries Institute in Bogor has expanded its extension programs to achieve this, but it is too early to assess the results.

Brackishwater fish production can be refined to an art, as on Taiwan. The money needed to reclaim more mangrove swamps will have to come from local sources because foreign investors are more interested in high-seas fishing. The prospects of the brackishwater sector are not as encouraging as other areas. Many existing ponds near Surabaya have been neglected. In some cases, sluice gates that control flooding have fallen into disrepair; the ponds themselves have become filled with silt.

Prospects for the swamp fisheries sector, to a great extent, are unknown. Presumably, the swamp areas would be harvested more intensively if the fisherman could sell a larger catch. At the same time, there would probably be a greater demand for swamp fish--if there were adequate means to transport the catch from remote swamp areas to urban markets and to store it.

Because it is attractive to the foreign investor, the marine (high seas) sector holds the greatest promise.



Malaysia

FISHING INDUSTRY PRODUCES 70-80% OF ANIMAL PROTEIN

The marine fishing industry is not one of the most significant sectors of the nation's economy, but it provides 70-80% of the animal protein consumed. The fishing industry has grown at a 7.5% rate during 1960-1965 and will continue to grow during the coming decade. Of total fish production, the marine fishing industry accounts for about 90%. For the First Malaysia Plan (FMP), the government has allocated during 1966-70 US\$7.4 million for training, research, installations and equipment to develop both fresh-water and marine fisheries.

In 1965, the first Malaysian fishing boats entered deep-sea fishing in the Indian Ocean. Industry leaders, traditionally oriented to areas within 50 miles of the Malaysian coast, are exploring the possibilities of expansion into deeper waters. Most crew members of the few deep-sea boats are Japanese because no Malaysians have been trained. The FMP calls for establishment of a Fisheries College to meet this need.

The Department of Fisheries in the Ministry of Agriculture and Cooperatives directs all marine science activities.

The Industry

The retail value of marine fish landings in 1965 was 2.2% of the gross national product (GNP); exports of fish and fish preparations were 1.1% of total 1965 exports.

68,000 Fishermen

Department of Fisheries statistics for 1965 show that the marine fishing industry in the states of Malaysia employs 68,000 fishermen. The industry operate about 22,520 boats and 18,000 licensed gear of about 70 types. The gear range from highly capitalized purse seines 250-300 fathoms long to primitive handlines, from giant fishing stakes (capitalized at US\$5,000-6,667 each) to small conical nets set in tidal runs and held in place by 2 poles fixed to the sea bed.

Of the 22,520 boats, about 12,300 are mechanized; 8,400 with diesel engines from 4 h.p. to over 200 h.p., and 3,900 with outboards. They fish not more than 50 miles from the



Fig. 1 - In Penang, many privately owned, well-equipped boats fish on large scale. Fishermen aboard are paid on daily or share-of-catch basis.
(Photos: FAO/S. Bunnag)



Fig. 2 - Penang fishermen put to sea in late afternoon. They use lighted oil lamp to attract fish at night.

coast. In 1965, they landed 198,400 tons of fish worth US\$58 million. Fishermen landed about 235,000 tons of fish in 1966, up 18 percent over 1965. This unexpected change is attributed almost entirely to the end of area tensions and the increasing importance of trawling.

In Sabah and Sarawak, the 1960 population census reported 6,000 and 5,500 fishermen, respectively. Sabah's landings in 1965 were estimated at 25,400 tons worth US\$6 million. No figures are available for Sarawak, but a conservative estimate is 6,000 tons annually.

Malaysia (Contd.):

Fish Used At Home

The bulk of the fish is marketed without dressing and consumed locally. Ice may be used, but its high price in many places and some consumer resistance adversely affect its use. Salting and sun-drying the salted fish is the most common form of processing. During 1961-1965, fish processing advanced, largely for export. Frozen tuna and fish meal were produced in Penang, frozen fish in Perak, and frozen prawns in Sabah.



Fig. 3 - Shrimps drying under Penang sun, one way to preserve them. They bring good price because, when mixed with food, they add as much flavor as fresh shrimps.

During the past few years, the fishing industry has been one of the faster-growing industries. Its annual growth rate during 1960-1965 was 7.5%, while the aggregate production index of other commodities was 4.8%.

The expansion resulted from the mechanization of fishing boats, widespread use of nets made of synthetic fiber, and improved fishing techniques.

The value of fish and fish preparations exported climbed from US\$6.3 million in 1960 to US\$12.3 million in 1965. About 70% of these exports were fresh, chilled, and frozen marine fish. While Singapore has remained the major destination, growing markets have been created in the U. S., Japan, and Thailand.

During the same period, Malaysian imports of fish and fish preparations remained at about US\$10 million per year. Fresh, chilled, and frozen marine fish; canned fish preparations; and salted, dry, or boiled molluscs account for nearly three-fourths of total imports. The major sources of fish imports have been Japan, Thailand, Singapore, and Indonesia.

During the First Malaysia Plan (FMP), 1966 to 1970, the annual fish catch is predicted to grow at a 6% rate. FMP's fisheries program is aimed at expanding research; training fishermen to be more competent; encouraging them to use improved equipment, gear, and other facilities; helping producers to improve processing and marketing methods; and establishing the facilities for large-scale and efficient marine fishing. The program amounts to US\$5.7 million in Malaya, US\$4 million in Sabah, and US\$1.3 million in Sarawak.

Marine Sciences

The Director of Fisheries, M. K. Soong, sees the underdeveloped state of fishing science as a major impediment to industry growth. A limited amount of quality research is being conducted by 7 research officers in the Department of Fisheries and at the Fisheries Research Institute under the Department. Both marine and fresh-water topics are studied. These researchers must confine themselves to compact problems--such as the biology of the cockle and early stages of the mangrove crab, rather than larger investigations requiring team work.

Fisheries science at the university and college level has not received the attention that agricultural science has. Graduates of the University of Malaya and the technical colleges--none offers diploma courses in marine sciences--do not have the desired background for fisheries administrative and research work. In May 1964, a postgraduate diploma course in fisheries was instituted by the Fisheries Biology Unit, Department of Zoology, University of Singapore. Two Malaysians have completed this course and are now working with the Department of Fisheries. About 12 other Malaysians are taking advanced courses required for fisheries development outside of Malaysia, mostly in Japan and Canada.

Malaysia (Contd.):

2 Marine Fisheries Schools

Under the first and second 5-year development plans, 2 marine fisheries schools were completed, one in Penang on the West Coast and the other in Kuala Trengganu on the East Coast. These schools train inshore fishermen in simple navigation, engine maintenance and repairs, and in fishing methods. The Penang school has been offering two 5-month courses per year and training about 60 fishermen annually. It was scheduled to offer a full year's course to about 30 fishermen. The Trengganu school runs three 3-month courses and takes in 90 trainees a year. The trainees receive an allowance from the Government to support their families while they study.

The Department of Fisheries initiated the planning of a Fisheries College for Penang modelled after Japanese and Canadian institutions. The development of modern, deep-sea, and oceanic fishing requires men trained in the technology and management of fishing enterprises. They are not available today because the 2 existing schools cater exclusively to inshore fishermen. The proposed college will provide 3-year training in navigation, fishing technology, marine engineering and electronics, fisheries economics and management, and fisheries products and refrigeration. A diploma in fisheries will be awarded at the end of the course. Local staff for the college are being trained overseas. The State Government of Penang has donated 87 acres. The college will have a hostel for 200 students. The total student enrollment will be 300.

In addition to the Fisheries College in Penang, the FMP calls for a fisheries training center in Sabah, and possibly a second fisheries center in Sarawak. To supplement the activities of these schools, fisheries mobile units will be set up. These units will visit fishing villages throughout the country to demonstrate the use of proper gear and equipment--and disseminate information on maintenance and repair of engines.

International Cooperation

Malaysia has not participated in many international cooperative ventures in marine science. In May 1967, the Malaysian Minister of Agriculture and Cooperatives, Mohammad Ghazali bin Jawl, returned from Thailand,

He announced that the two governments had agreed to survey the fishing resources off their coasts. The project began in February 1968 and lasted 6 weeks. The two governments are examining the density of ground fish and the variations in density with water depth. A similar joint study also is scheduled to be conducted in 1968 off the northern coast of Eastern Malaysia.

Japanese Investments

The Japanese have undertaken the major joint business ventures with the Malaysians in marine exploitation. The Malaysian-Japanese fishing company in Penang, Malayan Marine Industries, Ltd., produces about 800 short tons of frozen tuna and 500 cartons of canned tuna in brine each month. The tuna is produced for export. The U. S. is the principal market. Although the company was established in 1959, it relied entirely until 1965 on Japanese tuna catches. In 1965, Malayan Marine Industries sent the first Malaysian-flag boats into the western section of the Indian Ocean. The company has decided to add an eighth boat to its fleet. All but one, however, carry only Japanese crew members because there are no qualified Malaysians. The one training ship with Malaysians ventures only to intermediate distances in the Indian Ocean.

The Japanese have invested \$100,000 in the North Borneo Fishing Co., Ltd., a joint venture in which Malaysians hold 52% of the stock. This company fishes for prawns in the coastal waters off Sabah, exporting most to Japan. Most workers are citizens of Japan or Hong Kong. The Japanese wholly own a second prawn fishing company, Tropical Seafoods Ltd., in Sarawak. Their investment was \$78,000.

Both Taiwan and Korea have shown interest in basing larger parts of their deep-sea fishing operations in Penang. One Taiwanese company has formed a subsidiary, and the Koreans are considering a joint venture.

Foreign Help

Canada, France, Germany, and Japan have shown interest in helping to develop the fishing industry. The Canadians completed a feasibility study of the Kuala Kedah fishing port and are considering methods of financing it. A French team visited Penang to study development of the fishing harbor.

Malaysia (Contd.):

The Germans have also been approached for a feasibility study of a fishing port at Lumut.

The Malaysians have asked Japan for assistance. On Nov. 22, 1966, the Japanese and Malaysians signed a loan agreement of US\$50 million to finance development projects.

At the Southeast Asia Agricultural Development Meeting in Tokyo, in December 1966, Japan agreed to organize a group of experts to study the problems of establishing a research center for marine fisheries.

Fishing Conflicts

Since few Malaysian fishermen travel farther than 50 miles from the coast, there are few fishing conflicts with other countries. Hostilities between Indonesia and Malaysia from 1963 until 1965 restrained Malaysian fishing, especially in the rich coastal waters off eastern Sumatra. With confrontation over, Malaysian fishermen are venturing into the Straits of Malacca. Malaysian fish merchants are renewing contracts with Sumatran fishermen and fish dealers. Indonesian piracy poses a continuing problem in the Straits. Reports of incidents appear almost weekly in Malaysian newspapers.

Occasional trouble has arisen with Thai trawlers in recent months. The Thais have more experience with trawling than the Malaysians. The Thais have begun to outgrow their nation's limited inshore fishing grounds and are gradually moving into waters off Malaysia's northwest coast. Although questions of fishing rights hold potential problems, both countries would prevent serious incidents.

Indian Ocean Fishing A Possibility

The focus of expansion for the Malaysian fishing industry is the Indian Ocean, dominated almost exclusively by Japanese deep-sea fishermen. Only one Malaysian fishing company, Malayan Marine, partially owned and almost totally operated by the Japanese, is engaged in deep-sea fishing there. A second company in Prai, owned by a Malaysian, is studying opportunities in Indian Ocean fishing.



Pakistan

HOW SHRIMP ARE INSPECTED

Pakistan's shrimp industry consists of about 250 privately owned fishing vessels. In most cases, these are owned by their operators, although a few owners may have up to 6 vessels.

Fishing is traditional. The catch is stored aboard vessels in wicker baskets with chipped ice to avoid spoilage. These boats may remain out as much as 5 or 6 days, depending on how long it takes to catch a load. Once loaded, the boat returns to the Fish Harbor. There, one of 20 processing companies buys the catch at auction. The processing plants reject an average 20 percent of each boatload due to crushing and spoilage.

Handling Shrimp

Shrimp are received in the baskets used on boats. They are poured out in heaps on a cement floor. Workmen discard the spoiled or damaged ones, dehead the remainder, and place them in fresh water for washing and cleaning. Then the shrimp are ready for the next step. They are sorted according to size and divided up further, part frozen in the shell, but the greater part removed from the shell.



Shrimp and prawn business at 9-year-old Karachi market is good. Boys and men handle catch. When sold, it is hurried to one of processing factories built nearby. Most of these crustaceans are packed, frozen, and exported to N. America and Europe. (FAO)/J. Olsen

Once removed from the shell, the shrimp tails are again graded by size and quality; some are put into boxes and frozen in blocks. The best quality pieces are placed on trays, so that the pieces do not touch, and are individually quick frozen. These are packaged in cellophane or plastic bags.



Japan

3 MORE TRAWLERS TO FISH IN ICNAF AREA

The Japanese Fisheries agency will license 3 stern trawlers to fish north of 40° N., where a government-chartered stern trawler has been "exploring off Newfoundland." The vessels will be required to observe ICNAF mesh regulations. Six firms have asked to be licensed.

It is not known now whether the Fisheries Agency will grant 3 more licenses. Of the 8 to 9 trawlers licensed to fish south of 40° N., only 2 were reported there. All of the trawlers had been operating off Africa's north coast in the eastern Atlantic.

LONG LINERS REPORT GEAR DESTRUCTION BY PURSE SEINERS OFF MEXICO

Japanese tuna long-liners operating on the high seas off the Mexican coast report frequent gear damage and losses caused by purse seiners of other countries. Long lines have been cut, and glass floats and radio buoys destroyed. This seriously hinders operations.

The Federation of Japan Tuna Fishermen's Cooperative Associations claims such interferences will make it difficult to attain its tuna catch quota established under the Japan-Mexico Fisheries Agreement. The agreement became effective on June 10, 1968. The Federation plans to urge the Japanese Government to protest to the countries involved--and to send a guidance vessel to the area to protect the Japanese vessels. ("Katsuo-maguro Tsushin," June 14.)

SALES OF CANNED TUNA IN BRINE SLOW

The Japan Export Canned Tuna Packers Assoc. at a late May meeting agreed that measures must be developed to overcome slow sales of canned tuna in brine to the U. S. The canned tuna in brine inventory was around 1 million cases at the packers' level. At the rate of sales then, exports would fail to attain the 1968 export target--and could even fall far below 1967 shipments to the U. S.

Trading Firms & Packers Differ

The trading firms explained that export prices were around 80 cents per case too high. Unless the packers reduced their prices, it would be difficult to sell the product to the U. S. The packers, on the other hand, hoped to raise prices. They claimed they were paying US\$454-504 a short ton for the raw material and losing money selling their packs at the prevailing price.

As a possible solution to the high cost of raw material, the idea of buying tuna from South Korean and Taiwanese fishermen was discussed. The trading firms, however, indicated that negotiations for lower prices would be difficult so long as high prices prevailed in Japan. ("Katsuo-maguro Tsushin," May 28.)

FILM ALBACORE FEEDING BEHAVIOR

Tokai University's new oceanographic vessel, "Tokai Daigaku Maru Nisei," has succeeded in producing the world's first underwater video-tape recording of albacore tuna feeding behavior. The 702-gross-ton craft, built in Jan. 1968, used a specially designed television camera.

The recording was made on May 16, 1968, during the vessel's research cruise to the albacore grounds 25 miles north of Minami Torishima Island (south of Tokyo Bay).

How It Was Done

On that day, when a dense school of albacore was located, the TV was lowered from the side several meters. Pictures were taken for about 20 minutes during pole fishing. The camera obtained an unobstructed view of feeding behavior and hooking condition within a radius of 23-26 feet.

Film Will Be Studied

The University will closely examine each picture frame to study the speed of fish when they strike the bait, density of school, effects of water spray on biting condition, and other characteristics. This should provide more knowledge about albacore feeding behavior. ("Suisan Keizai Shimbum," May 28.)

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Mauritius

MOST JUNE TUNA PRICES STEADY

The Japanese Overseas Fisheries Co., Penang, Malaysia, which operates the tuna base at Port Louis, Mauritius, in the western Indian Ocean, announced it would pay these prices for tuna delivered to Port Louis in June.

Species	Exvessel Price 1968		
	June	May	April
(US\$/Short Ton)			
Albacore, round:			
Large--over 24 pounds	371	353	365
Small, under " "	252	257	257
* * *			
Yellowfin, gilled & gutted:			
Extra large, large, medium	315	-	-
Small	176	-	-
All sizes	-	302	302
Filletts--over 26 pounds	290	290	290
Big-eyed, gilled & gutted:			
Over 66 pounds	202	202	202
Filletts--over 26 pounds	315	315	315
Bluefin, gilled & gutted:			
Over 66 pounds	202	202	202
Filletts--over 26 pounds	-	264	264

Source: "Katsuo-maguro Tsushin," May 31.



Thailand

DELEGATION VISITS NORWAY TO STUDY FISHERY TECHNOLOGY

A Thai delegation representing major segments of the fishing industry visited Norway, March 25-April 7, to study fishery technology. The delegation leader and interpreter was M. L. Prachaksilp Tongyai, of the Marine Fisheries Laboratory, assigned by the Director General of the Department of Fisheries, Prida Karnasut.

Mr. Prachaksilp Tongyai reported to Commercial Fisheries Review:

"The fishing industry in Thailand has in recent years become progressively more mechanized. The landings from trawlers and purse seiners have steadily increased, but the fluctuations in fish prices have kept the fishermen from investing in enterprise-type fisheries.

"Fishermen and fisheries promoters, therefore, sought the aid of the Thai Department of Fisheries and the Norwegian Govern-

ment. Aid was granted for 5 fisheries representatives and one Fisheries Department official to visit Norway. . . ."

Norwegian Hospitality

Through the Export Council of Norway, the delegates were hosted by Norwegian companies and Scandinavian Airlines. "The delegates were able to acquaint themselves with the advanced fishery technology of Norway and begin business contacts which would help them to help themselves towards more efficient and economical utilization of fisheries resources of Thailand."

RATIFIES 1958 LAW OF THE SEA CONVENTIONS

On May 23, the Thai National Assembly ratified the 4 Conventions on the Law of the Sea adopted at the 1958 Geneva Conference. Thailand's official gazette published the ratification the same day. The last step required--depositing the ratification with the United Nations--was expected to take place soon.

Thailand claims a 12-mile territorial sea, proclaimed unilaterally in October 1966. (U. S. Embassy, Bangkok, May 28.)



Taiwan

FISHES FOR TUNA ROUND THE WORLD

The Taiwanese deep-sea tuna fleet numbers about 280 vessels; 90 of these were added during 1967. In mid-1968, about 50 vessels were fishing from Abidjan and Monrovia, 70 from Port Louis (Mauritius), 30 from Penang (Malaysia), 100 from American Samoa, 20 from Fiji Islands and vicinity, and 10-15 from St. Martin in Leeward Islands (Caribbean). The fleet shifts areas occasionally depending on tuna abundance and other factors.

1967 Landings

In 1967, Taiwanese tuna fleets landed about 80,000 metric tons of fish--half from deep-sea fisheries. Production plans for the end of the 5-Year Plan (1972) provide for doubling the annual tuna production to about 200,000 tons and exporting much of it.

Taiwan (Contd.):

70-80 Vessels in 1968

In 1968, the Taiwanese have scheduled to build 70-80 more tuna vessels. Of these, 50-60 are to be built in domestic, and about 20 in foreign, shipyards. Foreign-built vessels of about 250 gross tons each will be financed by a World Bank Loan (US\$7.8 million authorized several years ago). Domestically built tuna vessels will be 150-200 gross tons each.

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PLAN TRANSFER OF TUNA VESSELS
FROM AMERICAN SAMOA

The Taiwanese tuna fishery operators based in American Samoa have vessels which, in 1967, accounted for over 35 percent of tuna landings. They plan to transfer their large refrigerated vessels to other oceans because the South Pacific catch is declining.

The Samoa-based Taiwanese fleet is about 70 vessels, about 50 equipped with refrigeration. The Taiwanese hope to use their large, 200-gross-ton, vessels in the Indian and Atlantic oceans.

Good Seasonal Fishing

There, the seasonal fishing for yellowfin and albacore is good. They expect no difficulty in finding suitable bases for their operation. This is because in the Indian Ocean the Japanese Overseas Fisheries Co. operates a large tuna base at Port Louis, Mauritius; in other areas, the Japanese trading firms are actively seeking to contract Taiwanese vessels to fish for them.

The China Marine Trading Co. also will represent Taiwanese vessels that will land fish at Port Louis and at Tema, Ghana. ("Suisan Tsushin," May 24.)



TONGUE OF THE OCEAN

The Tongue of the Ocean, a 160-kilometer-long, 3,600-meter-deep under-sea canyon in the Bahamas, has been a deep-water feature for at least 13 million years, probably longer.

The limestone that forms the rugged outcrops in the canyon walls was not made from the sediments that presently are accumulating in the area, according to a report by two U. S. Geological Survey scientists.

Comparison of data from test wells on nearby Andros Island with the depths of the rock formations in the Tongue of the Ocean suggests that the strata have either slid downslope into the canyon or been down-warped in that area.

Conditions similar to the present have prevailed since the late Miocene epoch when the rock was apparently formed under 300 meters or more of seawater, according to Survey scientists Thomas G. Gibson and John Schlee.

"We do not know how the outcrops formed, but suggest slumping on the side of the canyon as a possible explanation."

The team studied the giant submarine canyon from the research submarine "Alvin" in August 1966. They made two dives approximately five kilometers southwest of New Providence Island ranging in depth to 1,676 meters. (Reprinted, with permission from "Science News," weekly summary of current science, copyright 1966, by Science Service, Inc.).

SOUTH PACIFIC

Australia

IMPORTS OF FISH OILS DROP

Australian imports of marine animal and fish oils dropped considerably in FY 1966/67 (July 1, 1966, to June 30, 1967), compared with imports in FY 1965/66. Exports also were down. (Agricultural Attaché, U. S. Embassy, Canberra, May 24, from Commonwealth Bureau of Census and Statistics.)

	Imports	
	FY 1966/67	FY 1965/66
	. . . (Imperial Gallons) . . .	
Marine Animal and Fish Oils:		
Whale oil	747,068	1,718,352
Cod-liver oil, incl. refined .	92,591	107,495
Seal and fish oils, unrefined .	60,563	82,094
Other marine animal oils . .	7,136	14,626
Processed Oils (Boiled, oxidized, dehydrated, blown, or polymerized):		
Cod-liver oil	Not available	20
Whale oil	102,112	59,472
Other marine animal and fish oils	7,686	12,021
	Exports	
Whale oil	932,934	1,287,603
Other marine animal and fish oils	471	1,828



New Guinea

JAPANESE-AUSTRALIAN SHRIMP VENTURE RUNS SMOOTHLY

The South Sea Fishing Co., a joint Japanese-Australian shrimp fishing venture established in Port Moresby, New Guinea, in early 1967, is operating smoothly and profitably. The company operates one 350-ton freezer ship converted from a tuna vessel-- and 5 shrimp vessels that trawl off the southern coast of New Guinea.

Principal catches are tiger shrimp, averaging heads off 20 a pound, the size very easy to sell in Japan. ("Suisan Tsushin," April 30.)



New Zealand

BROADENS FISHING INDUSTRY SUBSIDIES

New Zealand has joined the ranks of nations increasing subsidies to their fishing fleets. She has broadened her subsidies to provide for purchase of new and used vessels, new engines for replacement, gear and equipment, mortgage guaranties, loans, and refinancing of loans.



BCF Holds Fishery Workshop on Okinawa

Three scientists from BCF's Biological Laboratory in Honolulu held a fishery workshop for researchers on Okinawa in May at the invitation of the government of Ryukyu Islands. The 3 were Richard S. Shomura, Deputy Area Director, and Tamio Otsu and Brian J. Rothschild, fishery biologists.

The workshop was held for scientists of the government's Fishery Division and the University of the Ryukyus.

The Ryukyus

Okinawa is the most important of the 73 Ryukyu Islands lying between Japan and Taiwan. Nearly 90 percent of the million Ryukyans live in Okinawa. Agricultural land is scarce and the islands are seeking ways to strengthen their fisheries.

The Honolulu scientists are interested primarily in skipjack tuna (aku) because it is the principal Hawaiian fishery. Okinawan catches are 8 million pounds; the Hawaiian average is 10 million. However, there are many more vessels and fishermen in Okinawa.

How Skipjack Is Processed

On Okinawa, most of the skipjack tuna catch is smoke-dried and made into "katsuo-bushi" (skipjack sticks). Most of the Hawaiian product is canned. Both fisheries are seasonal and peak in midsummer.

Fishery Techniques Similar

The fishing techniques are similar. In Okinawa, and in Japan, the skipjack are attracted to the ship by live bait and are caught with pole and line. In Okinawa, bait is relatively scarce.

Workshop Aboard Ship

The BCF scientists met with fishermen and inspected fishing operations. In the work-

shop, they discussed the methods used to study skipjack in their Honolulu lab.

They spent several days at sea demonstrating method of tagging skipjack. The purposes are to study migrations and other aspects of the skipjack life history.

As a result of the workshop, scientists of Okinawa's Fisheries Research Institute have promised to conduct a comprehensive tagging program this year.



PROPER PRECAUTIONS TO KEEP FISH FRESH FOR TABLE

Certain steps are in order if the fisherman wants his catch to reach the dinner table in the best possible condition, says Henrietta Gossett, home economist in the Seafood Marketing Division of the Texas Parks and Wildlife Department.

According to Miss Gossett, a few simple steps will retain freshness and help identify good quality fish.

The fish should be cleaned as soon as possible after it is landed with all of the internal organs removed. An alternative to this is to keep the fish alive in bait wells or on a stringer.

Since fish decomposes rapidly, it should be refrigerated as soon as possible. The lower the temperature, the slower the rate of spoilage, so ice would be a good investment to protect the catch.

Miss Gossett says that bruising and crushing hasten spoilage, so fish should be handled as little as possible.

To assure selection of fresh fish, she suggests that a few qualities be observed:

Fresh fish have full and transparent eyes. Sunken eyes are a sure sign of bad fish. Shiny skin is another clue to good fish. Gills on fresh fish are bright red or pink and become progressively duller as the fish spoils. Firm, elastic flesh which clings to the bone is another sign the fish is fresh.

Fish should have only a mild odor. If the fish has a strong, putrid odor, it should not be eaten.

Here are a few other hints which will heighten the enjoyment of fish:

Fresh fish should be rinsed in cold water and drained on absorbent paper. If the fish is to be cooked within the next 24 to 36 hours, it should be placed in a covered bowl or in plastic wrapping in the coldest part of the refrigerator. If the fish is to be kept for any time longer than 24 to 36 hours, it should be rinsed, drained, and wrapped tightly in moistureproof, vaporproof paper and placed in the freezer.

By following these procedures, the fish will retain a maximal moisture level, and the odor of the fish will not be transferred to other foods in the refrigerator.

Fish should not be frozen in wax paper, parchment paper, or polyethylene materials, which are not moistureproof and vaporproof.

When fish thaws, it should be cooked immediately and never refrozen. Frozen fish should be thawed in the refrigerator at 37° to 40° F. The fish should be held at this temperature only long enough to permit ease of preparation. It takes about 24 hours to thaw a one-pound package in this manner.

If a quicker method is necessary, the fish, still wrapped in the moistureproof, vaporproof wrapping, may be held under cold running water. One to two hours should be allowed for thawing a one-pound package by running water over it. (Reprinted from Texas Parks and Wildlife Department "News.")

AFRICA

1968 FISH CATCH UP IN SOUTH AND SW AFRICA

South Africa's Cape west coast shoal fish catch for the first 2 months of the 1968 season, excluding both factory ships, was 67,224 short tons of pilchards, 867 of maasbanker, 23,410 of mackerel, 20,370 of anchovy, and 1,815 of red-eye herring. The total: 113,677 tons.

In the 1967 period, the catch was 110,319 tons: pilchards 48,551 tons; maasbanker 3,216; mackerel 9,526; anchovy 57,341; and red-eye herring 1,685 tons. In 1966, the Jan.-Feb. total was 54,928 tons: pilchards 20,772 tons; maasbanker 8,248; mackerel 9,400; anchovy 12,987; and red-eye herring 3,521 tons.

January 1968 Figures

The Division of Sea Fisheries reported the Jan. 1968 catch comprised pilchards 23,896 tons; maasbanker 696; mackerel 21,923; anchovy 10,810; and red-eye herring 836 tons. The total catch was 58,161 tons. In Feb., the total catch was 55,516 tons: pilchards 43,328 tons; maasbanker 171 tons; mackerel 1,478; anchovy 9,560; and red-eye herring 1,815 tons.

In Feb. 1967 the figures were: pilchards 34,763 tons; maasbanker 1,579; mackerel 8,957; anchovy 23,814; and red-eye herring 1,685 tons. In Feb. 1966: pilchards 16,135 tons; maasbanker 1,889; mackerel 6,062; anchovy 6,034; and red-eye herring 3,521 tons.

The Jan. 1968 catch yielded 13,467 tons of fish meal, 543,252 gallons of fish body oil and 1,852,512 lbs. of canned mackerel. In Feb. 1968, the catch yielded 13,664 tons of fish meal, 289,118 imperial gallons of fish body oil, and 101,136 lbs. of canned mackerel.

South-West Africa

In South-West Africa, the Jan. 1968 shoal catch was 14,862 tons of pilchards and 72 tons of anchovy; these yielded 3,872 short

tons of fish meal and 1,298 long tons of fish body oil. The Feb. catch reached 69,170 tons of pilchards, 3,575 tons of anchovy, and 54 tons of maasbanker; the catch yielded 16,766 tons of fish meal and 5,240 tons of fish body oil.

Pilchard boats were making good catches both north and south of Walvis Bay in March. The oil yield was still high, averaging around 23 imperial gallons per ton of fish.

However, the snoek fishing had deteriorated. Only a few Cape Town boats were reported operating. ("The South African Shipping News and Fishing Industry Review," April.)



South Africa

FACTORYSHIP HAS GOOD TRIP

The 31,000-ton South African fish factoryship "Willem Barendsz" arrived in Cape Town, South Africa, in early June with a processed fish catch worth about US\$1.6 million. The catch already had been sold to European buyers. This is the vessel's best earnings in about 18 months as the country's first fish factoryship.

Large Catch

In 6 weeks, the ship's 10 seiners caught about 52,000 metric tons of pilchards. These were processed by the factoryship into 12,500 metric tons of fish meal and 3,600 long tons of fish oil.

The ship steamed as far as 1,000 miles from Cape Town to find the fish. ("South Africa Digest," June 7.)



MID EAST

Iran

SHRIMP INDUSTRY

The Iranian Government has turned over shrimp catching, freezing, and exporting rights to 2 private firms. The frozen shrimp are delivered from factoryship to refrigerated cargo ships for transport to the U. S. Quality controls and sanitation are reported by the Iranians to be equal or better than those of U. S. producers in the Gulf of Mexico. Ships have U. S. processing supervisors aboard who have worked in the Gulf of Mexico.

2 Concessionaires

Concession rights to catch, freeze, and export shrimp are granted by the government-owned Southern Fisheries Co. (SFC). Only 2 companies are using their concessions: Gulf Fisheries Co., a Kuwaiti firm, and Ross Persian Seafoods Corp., a British-Iranian venture. Gulf catches about 2,000 metric tons of shrimp a year, twice Ross' catch. The U. S. and Japan are the largest consumers.

The Operation

Ross Persian has fifteen 80-foot trawlers and 2 factoryships, 4,000 and 2,000 net tons. The trawlers deliver the catch to the factoryships, where the shrimp are processed, graded, and frozen into 5-kilogram (11-pound) packages. Periodically, the packages are transferred directly from factoryship to cargo vessels of the Concordia Line for delivery to the U. S.

The frozen shrimp for export are never landed in Iran. The shrimp are cleaned and the heads removed before freezing; the shrimp are not deveined until they reach the U. S. for further processing.

The processing and sorting machinery is U. S. made. Nearly one-fourth the personnel processing shrimp are U. S. or European nationals.

Gulf Fisheries operates similarly, although it has 30 trawlers and production is proportionately higher.

Inspection

Dr. Amin Keyvanfar, a marine biologist, supervises sanitation and quality controls over shrimp harvest in the Persian Gulf's Iranian waters. He works for the government-owned Southern Fisheries.

According to Dr. Keyvanfar, the shrimp are caught, separated from rest of catch, decapitated, and washed with sea water. Then they are placed in 5-pound cans (with one pound of sea water added), frozen on ship at -35° C. (-31° F.) and stored at -25° C. (-13° F.). The catches are transferred to motor ships at least weekly and are transferred again to cargo ships at least monthly.

Dr. Keyvanfar visits trawlers and mother-ships at random to insure maintenance of sanitation.

No precautions are taken or preservatives used to prevent enzyme spoilage. (U. S. Embassy, Tehran, Mar. 6, Apr. 20.)



United Arab Republic

FISHERY DEVELOPMENTS

Three of the 8 new refrigerator trawlers ordered by the United Arab Republic (UAR) from Spain were delivered and now are fishing together off West Africa.

The vessels, about 140 feet long, reportedly have a nonstop range of 15,000 miles and a refrigerated hold capacity of 850 tons. Another 14 modern trawlers are scheduled to be built at the Alexandria shipyards to complete the planned UAR high-seas fishing fleet.

Sponge Fishers

UAR sponge fishers harvested 500,000 pieces off the country's Mediterranean coast last season. Until 2 years ago, the area was fished under a concession agreement with Greek entrepreneurs.

High Dam Cuts Catch

Though complete figures are not available, indications are that the catch from the Nile Delta lake and offshore areas--normally about half the UAR's fish catch--has fallen noticeably in the last 2 years. This resulted from the operation of the High Dam. In holding back the Nile flood, the dam also held back much food in the flood waters. Apparently, the UAR's sardine catch has been particularly affected. (U. S. Embassy, Cairo, June 11.)



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Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

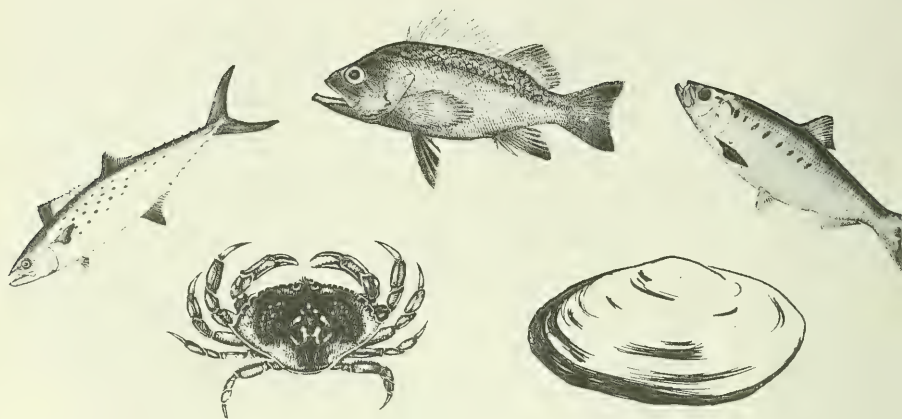


UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES



Development of Underutilized Fishery Products



The Bureau of Commercial Fisheries works with the domestic fishing industry to develop markets for presently underutilized fishery products. The Bureau's recent accomplishments include markets developed for Spanish mackerel, mullet, Northern shrimp, ocean quahogs, soft shell clams, and Pacific Coast groundfish.

These products are being introduced to chain restaurants, cafeterias, and retail food chains. As a result of Bureau efforts, several of these outlets are now merchandising underutilized products.

COMMERCIAL FISHERIES *Review*

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Fishes

OCTOBER 1968



COVER: Giant turtles at Chimbote, Peru. Caught locally, they are brought to market and left on their backs to die.

(Photo: FAO/S. Larrain)

COMMERCIAL FISHERIES

Review

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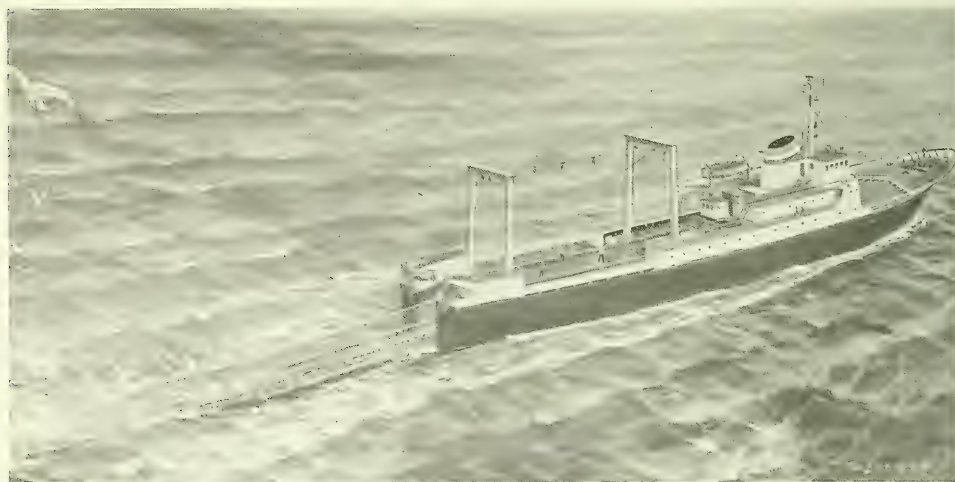
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(Photo: J. Puncchar)



LARGEST U. S. FISHING VESSEL CHRISTENED IN BALTIMORE

A \$5 million, 297-foot, 3,120-ton freezer stern trawler--the SEAFREEZE ATLANTIC--was christened at the Maryland Shipbuilding and Drydock Co. in Baltimore on September 21. Nearly as long as a football field, she will be the largest fishing vessel to fly the U. S. flag and be able to compete with the latest foreign vessels. Her sponsor was Mrs. John A. Volpe, wife of the Massachusetts Governor.

A sistership, the SEAFREEZE PACIFIC, will be christened in December.

Owner of the vessels is American Stern Trawlers, Inc., a subsidiary of American Export Industries. The vessels are being built with the aid of a subsidy provided by the U. S. Department of the Interior under the 1964 Fishing Fleet Improvement Act. BCF administers the subsidy program.

The SEAFREEZE ATLANTIC will be based in Gloucester, Mass., and fish the Grand Banks and off Labrador. The SEAFREEZE PACIFIC will fish off the Pacific Northwest from her West Coast base.

What They Will Do

The vessels will be able to stay at sea 2 months and process their catch. Each can

catch, clean, package, and freeze 2 million pounds of fish on one voyage. Assembly-line equipment "will sort, head, gut, wash, fillet and skin the catch from the ocean floor and have it packaged and frozen in a matter of hours." Refrigerated holds will maintain packaged fish at -20° F.

The trawlers are designed 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.

Well Equipped for Fishing

Both ships are equipped for both bottom and midwater trawling and can work in bad weather. Sonars will locate and track fish schools and warn of obstructions on the ocean floor. Deck machinery will exert a 20-ton pull on the trawl. Each vessel will carry 6 of the largest nets ever made. The bottom-sweeping net is 600 feet long, 60 feet high, and 120 feet wide.

The Sisterships

The trawlers are powered by 3 General Motors diesel engines generating 3,200 shaft horsepower. They will cruise at 14.4 knots, carry a crew of 56 in air-conditioned cabins, and be able to cover 26,000 miles.



UNITED STATES

U. S. Vessels Make Good Tuna Catches in E. Atlantic

At least 8 U. S. vessels were in the Eastern Atlantic in second-half September making good catches: about half yellowfin, half skipjack. Landing capacity loads at Abidjan, Ivory Coast, Africa, were the seiner "Caribbean," 700 tons of tuna, and the "San Juan," 1,000 tons.

Early in September, the "Nautilus" and "Bold Venture" landed capacity loads at Tema, Ghana (probably total of 1,800 tons).

Yellowfin were reported large: some up to 100 lbs. each.

The Fleet

Total capacity of the 8 vessels is 6,800 tons. With fishing good in the Eastern Atlantic and poor in the Eastern Pacific, more vessels were expected to move into the Atlantic. In 1967, only 3 vessels were there.

Landings were largely transhipped to Puerto Rico.



EDA Aids Fishing Industry

Between August 1965 and June 1968, the Economic Development Administration (EDA) helped finance 48 projects to improve or expand port, harbor, and dock facilities.

Individual projects ranged from a grant of \$10,125,000 to finance a wharf and transit shed, and to develop land, back-up land, container yard, and access roads in Oakland, Calif.--to a \$2,000 feasibility study on construction of a town dock and marina in Harborside, Town of Brooksville, Maine.

EDA invested \$8,402,000--65% of the total cost--in 13 projects developed specifically to benefit the commercial fishing industry.



1968 Import Quota for Tuna Canned in Brine

The quantity of tuna canned in brine that may be imported into the U. S. during 1968 at the 11-percent rate of duty is limited to 66,985,048 pounds. This is about 3,189,764 standard cases of 48 7-oz. cans. The limit is about 3.6 percent less than the 69,472,200 pounds (about 3,308,200 cases) in 1967; 2 percent over 1966's 65,662,200 pounds (about 3,126,771 cases); 1.4 percent greater than the 66,059,400 pounds (about 3,145,685 cases) in 1965; and 10 percent over the 60,911,870 pounds (about 2,900,565 cases) in 1964.

22% Duty Above Limit

Any imports of tuna canned in brine over the 1968 quota will be dutiable at 22 percent ad valorem under item 112.34, Tariff Schedules of the U. S.

The 1968 quota is based on the U. S. pack of canned tuna during the preceding calendar year (1967), as reported by the U. S. Fish and Wildlife Service.

First Quarter Imports

U. S. imports of tuna canned in brine during Jan. 1-Mar. 30, 1968, were 14,616,675 pounds (about 696,032 standard cases). These are preliminary data of the Bureau of Customs, U. S. Treasury Department.



Pair Trawling on Georges Bank Presents Hazard

U. S. fishing vessel captains are being warned of a hazard connected with pair trawl fishing on Georges Bank by foreign fishing vessels.

Pair trawlers use a single trawl, towing the net between them. In most cases, the vessels have a nylon line running from bow to bow. The trawlers proceed on a parallel

course about 150 yards apart. Fishermen who observe vessels operating this way should assume that they are pair trawlers and avoid running between them.

Few Signals Displayed

Although the recent London Fisheries Policing Conference agreed to have pair trawlers use the international code signal "T," a red, white, and blue vertically striped flag during daylight, and crossed search lights focused ahead of the vessels at night, few if any pair trawlers display these signals.

Radar should be watched closely during low visibility for parallel-course vessels. They could be pair trawlers.



Fur Seals Discovered Off California

A breeding colony of fur seals (*Callorhinus ursinus*) was discovered on San Miguel Island off the California coast on July 20 by Dr. Richard Peterson, University of California, Santa Cruz, and Robert DeLong, Smithsonian Institution, Washington, D. C. It is the first confirmed record of the northern fur seal breeding on any eastern Pacific island other than the Pribilofs.



Breeding colony of northern fur seals discovered on San Miguel Island, about 30 miles off Point Conception, California.

(Photo: National Park Service)

The Colony

The colony had about 100 animals, including one adult male, about 60 females, and 40 pups. About 35 of the females were checked for tags and checkmarks. One had a tag applied on the Commander Islands; 4 or 5 had been tagged on the Pribilof Islands.

Acoustical Workshop Slated for Seattle in November

An Acoustical Workshop will be held at BCF Exploratory Fishing and Gear Research Base in Seattle, Wash., Nov. 25-27. It will be open to the scientific, academic, and industrial communities.

Major emphasis will be placed on equipment, techniques, and applications for acoustically determining species composition and magnitude of living and aquatic resources.

Open House On 'Cobb'

During Nov. 18-22, participants will be able to board BCF's John N. Cobb to see the recently installed Triton acoustical counting system. One of the system's developers, Ron Mitson of Britain's Lowestoft Fisheries, will demonstrate its operation and discuss the procedures.



AEC Aids in Columbia River Thermal Study

The Atomic Energy Commission is joining Interior Department's Federal Water Pollution Control Administration and BCF in a study underway since February to determine whether hot-water discharges are polluting the Columbia River.

The study of the effects of thermal discharges from nuclear power plants and other sources is scheduled for completion in July 1970. One purpose is to find out what effect the heat discharges have on the river's ecology--and particularly the salmon and other fish in this stream.

1970 Report

Representatives of the 3 Federal agencies have agreed on research steps needed to find the effect of temperature on cold-water fish in the Columbia. Each agency has part of the research responsibilities.

"Although the final report to be issued in 1970 will be a team effort of the 3 agencies, the FWPCA has principal responsibility to

complete the final report," Interior Secretary Udall said.

The study also will provide needed information for the mathematical models developed to evaluate and predict temperatures in the Columbia under a variety of conditions.



Biologists and Engineers Discuss Thermal Pollution

About 200 people attended a national symposium on thermal pollution in Nashville, Tenn., Aug. 14-16, cosponsored by the Federal Water Pollution Control Administration and Vanderbilt University. The participants represented electrical utilities, the U. S., States, and universities.

They discussed temperature in the aquatic environment and its relation to "water quality standards, biological requirements, mixing of heat in natural waters, modeling heated water discharges, design of cooling towers, and the economics of cooling water discharges."

Need for Meeting

Observers said that the need for communication between biologists and engineers was evident at the meeting. Biologists are being asked to provide estimates of critical temperatures for aquatic organisms. The estimates will be difficult to get in many cases. And the engineers--to keep waste out of the natural environment--will have to turn to very expensive and relatively untested devices, such as cooling towers.



U. S. Families Asked About Their Seafood Tastes

The first questionnaire in a year-long survey of U. S. seafood-eating habits is scheduled to be distributed in October. BCF awarded a \$95,400 contract to Market Facts, Inc., of Chicago, to conduct the survey. Biweekly, a representative sample of U. S. households across the Nation will report the type of fish and shellfish it buys and how it prepares them. This information will be related to size, age,

sex, income, and religion of household members, and occupation of household head.

BCF will use this information in its continuing study of factors that influence the eating of fishery products.

Study results will be provided to the fishing industry and processors. The information should help them to better serve the public.



Shad's Return to Susquehanna Is Assessed

A century ago, a man heading for California loaded into the train's baggage car milk cans with live small shad he had taken from New York's Hudson River. When he got to California, he released them into the Sacramento River. Many years later, the descendants of those fish were returned to the Eastern Seaboard and, in 1965, they became part of a Federal-State study to determine whether shad could be restored to the heavily dammed Susquehanna River.

The Report

The study team found that "shad eggs can hatch, larvae can develop, and juveniles can survive and prosper in most of the Susquehanna River." The team's findings are contained in a 60-page booklet recently issued by the Bureau of Sport Fisheries and Wildlife.

The report states that the next questions to be asked are whether enough adult shad with a strong urge to migrate upstream are available, whether the designed fishways would attract fish, and whether adults would move efficiently upstream through reservoirs. "The broad question of the total desirability of installing one or more fishways on the Susquehanna... lies with the separate State and Federal agencies."

Power Companies Aided Study

Cooperating in the study were BCF, New York Conservation Department, Pennsylvania Fish Commission, and Maryland Board of Natural Resources.

Power companies contributed \$196,500 for the study.



AQUACULTURE: Its Status and Its Potential

Farming the sea--aquaculture--can make an important contribution to a global war on hunger and to the domestic economy of the United States.

This conclusion is reached by two researchers, Prof. John E. Bardach, University of Michigan, and Dr. John H. Ryther, Woods Hole Oceanographic Institution (Mass.), in their report, "The Status and Potential of Aquaculture." The report was prepared for the American Institute of Biological Sciences under contract to the National Council on Marine Resources and Engineering Development (Marine Sciences Council).

It is published in 2 volumes: Volume I deals particularly with invertebrate and algae culture; Volume II with fish culture.

Prof. Bardach and Dr. Ryther state: "Immediate benefits to the United States arising from expanded practice of aquaculture here would be the increased production of high quality food items now considered luxuries because of limited supplies, and the economic rejuvenation of a sector of the fishing industry (mollusca shellfish) now severely depressed."

The two experts emphasize that the United States has the scientific skills needed to make major contributions to aquaculture--but at present no single agency of the U. S. Government is responsible for coordinating efforts in this field, and private activities too are scattered.

They believe that aquaculture--particularly the highly efficient and productive herbivorous forms--can help to alleviate world hunger. This can be achieved by: applying recent scientific and technological advances to existing practices, particularly in the world's developing countries; fashioning new methods or techniques with the aid of such disciplines as genetics, nutrition, pathology, ecology, and engineering; and opening new geographical areas to aquaculture.

The major points of the Bardach-Ryther report are summarized below.

GENERAL PRINCIPLES OF AQUACULTURE

The intensive culture of aquatic organisms--in contrast to capturing them from

untended stocks--is carried out in many areas of the world. It is more prevalent and successful in fresh and brackish waters than in the sea itself. But Japan, the USSR, and Great Britain are attempting genuine marine husbanding.

Existing data do not reveal the "world tonnage of fish, invertebrates and aquatic plants produced by such active interference of man in the natural life cycles of the organisms or in the management of their environment." The authors estimate that total tonnage produced by aquaculture may lie between 5% and 10% of total world fish catch. They quote an estimate that, for fresh and brackish water alone, the consistent use of the best techniques could raise fish tonnage produced by aquaculture 3 to 5 times--to around 30 million metric tons. Intensive aquaculture in "waters of full marine salinity is in its very infancy."

Few Fishes Raised

The 25,000 species of fishes form the largest class of vertebrates, but very few of these have been raised by intensive husbandry. Even fewer species have been domesticated like some mammals and birds. And still fewer aquatic invertebrates have been cultured successfully. Yet, the authors state, it is possible today with intensive care to produce "significantly larger amounts of high-grade animal protein per unit of inshore or freshwater surface than on fertile dry land."

"Artificially fed fish (carp) increase in weight 2-2.5 times more than cattle or sheep" in terms of increase per unit weight of animal per unit weight of food consumed. The oysters on 1 acre of sea bottom have access to the food in thousands of acres of water flowing past them. In principle, "a few hundred pounds of beef cattle can be raised in an acre of very good pasture"--but a ton or more of fish and a hundred tons of shellfish may be cultivated in the same aquatic area.

WHICH ORGANISMS TO CULTURE?

The authors examine the biological properties of organisms that would make them most suitable for intensive culture:

- They should reproduce in captivity or semiconfinement--or be easy to manipulate for the purpose of producing offspring. The

Pacific salmon dies after spawning, eliminating the need to keep spawners alive; this makes it easy to handle one stage of the culture operation. If breeding is not easy, the larvae or young should be easily available for gathering.

- "Their eggs or larvae should be hardy and capable of being hatched or reared under controlled conditions."

- The food needs of larvae or young should be satisfied by operations that can increase their natural foods--or they should be able to take prepared feeds from their early stages.

- They should gain weight fast and nourish themselves entirely or partly from foods that are available in abundance and can be supplied to them cheaply--or can be readily produced or increased by man where the cultured species lives.

The authors say there are few aquatic organisms that would not have problems with 1 or more of the 4 qualities; only a handful combine all these attributes.

PROBLEMS OF AQUACULTURE

Several problems are commonly encountered in aquacultural practices:

- The many subtle qualities of the environments--such as temperature, salinity, oxygen, etc.--determine whether an animal or plant will reproduce at all.

For most marine organisms, these conditions are not known exactly. Only in a few cases has it been possible to duplicate the necessary conditions. But these problems are less difficult than they seem at first. Many aquatic, especially marine, organisms produce enormous numbers of eggs and larvae. In some cases, these larvae can be collected from nature before they die in vast numbers and can be raised in culture (e.g., milkfish). However, this practice prevents mass selection for desirable characteristics--the very foundation of animal husbandry--because the parents with these characteristics are not available.

Also easing the problems of aquaculture is a relatively recent practice that already has had far-reaching effects on fish culture: injection of pituitary hormones that ripen the fishes' gonads and allow forced and controlled

spawning of species--e.g., grass carp and possibly mullet--which had not been propagated artificially before.

- Unlike higher forms of life, many fish and most invertebrates have larval forms that bear little resemblance to the adult. "Culture of such organisms through their larval cycle requires basic knowledge, facilities, and techniques which differ entirely from the practices involved in growing the adult." Often, rearing the larvae is by far the most difficult part of successfully culturing a species. "For example, the spiny lobster has not yet been successfully brought through its 20-25 larval stages in culture."

- "Often the principal objective of aquacultural enterprises is to grow as many organisms in as small a space as possible." This crowding produces problems: feeding, growth, metabolism, behavior, morphology, accumulation of toxic wastes in the water, rapid transmission of disease and parasitism, and often cannibalism. The last is the main obstacle to the culture of many crustaceans, notably the American lobster.

AQUACULTURE'S PROGRESS

Despite these difficulties, the authors state, aquaculture has made important progress in many parts of the world. The incentive is profit. The species selected, the luxury foods, bring the highest price to the culturist. While this seems inconsistent with the goal of easing the world protein deficiency through aquaculture, it is not necessarily so. When luxury foods become sufficiently abundant, they stop being a luxury. A high-priced market may be the initial incentive to culture a species and may justify research and development funds.

The important factor, the authors emphasize, is not the product's status or market price. It is production cost in dollars and/or in protein food. This is one of aquaculture's principal problems. The reason is that the species in culture, excepting molluscs and several fish species, are predominantly carnivores or omnivores 2 or more levels in the food chain above the photosynthetic base. Each step up the ladder means a loss of about 90% in converting food to new animal tissue.

This conversion can be done economically where the product is extremely valuable and the food may be obtained cheaply. In Denmark,

for example, small herring and trash fish from the North Sea are fed to rainbow trout. In Japan, shrimp are fed small shellfish, fish, and commercially caught shrimp of low market value.

The authors report great progress in compounding land-produced waste foodstuffs, fortified with animal proteins and vitamins, into cheap and readily available food for fishes. These practices are sometimes comparable to the mechanized, mass production of chickens, fish meal, and other prepared foods in the U. S. and Europe. In modernizing the chicken industry, the chicken was reduced from a luxury food to an inexpensive, staple, meat product.

To achieve the goal of increasing the world's protein supply, the herbivorous species should be used. They feed at the photosynthetic base of the food chain. There is only one step in the conversion from plant matter to animal flesh. And, in contrast to land forms, they use microscopic plants that still remain unharvestable and unuseful to man. The ways to increase them above their natural yields--insofar as they are the food of animals raised with aquacultural practices--are an integral part of aquaculture.

The authors state that "almost staggering amounts of certain shellfish can be produced even with existing techniques." A 1,000-square-mile area--the size of Long Island Sound--if ecologically suitable, could produce each year 3 times as much mussel meat as the world's total fish catch. The authors point out, however, that this example is specious unless such areas are available for aquaculture. "Thus, an evaluation of the potential of aquaculture must include not only the ecology of the organism and technical aspects of its culture, but also consideration of geographic, demographic, sociological, and economic facts as well."

INTENSITY OF AQUACULTURE

To gain estimates of the ranges of flesh production from aquaculture, it is more meaningful, the authors say, to establish categories showing the intensity of culture rather than to divide the practices into fresh, brackish, and salt-water practices.

The following are the author's arrangement of categories by "ascending intensity" of labor and capital input and, by and large, by increasing yields:

- Transplant species from poor to better growing grounds: in Denmark, North Sea plaice to selected fjords; introduce species into new environments along with selected food organisms of these species--as in Soviet Union. ". . . this method of extensive culture shows little economic promise, or has, at best, qualified success, locally."

- Stock hatchery-reared juveniles to augment and replenish natural stock. This is done with various anadromous salmon species. New hatchery techniques give this practice a more favorable cost/benefit ratio.

- Enclosures to retain organisms, or devices on which they are put--either by themselves or after they have been collected: prawns in Malaya, mullets and eels in Adriatic "Valli" culture. The water in the enclosures is not fertilized, nor are the animals fed; mollusc culture and Japan's culture of marine algae are in this category.

- Fertilize ponds or enclosures shut off from the sea: milkfish in Southeast Asia; some carp culture in Northern hemisphere; some Tilapia culture in Africa and Near East; and some shrimp culture in Southeast Asia.

- Enclosures and ponds in which the water is fertilized and more food is supplied to the animals: catfish in U. S., most carp culture in Northern hemisphere, some milkfish and mullet culture, and culture of Chinese carps in China and Far East.

- Enclosures, often cement, in which the animals are raised only by extraneous feed. This compares somewhat with intensive chicken-raising methods in U. S. and Europe. Volume of flow, not surface, is important in this category, which includes: Salmonid--trout and salmon culture in U. S. and Europe, shrimp in Japan, carp and eel in Japan, and experiments with plaice and sole in Great Britain.

YIELDS

Intensive pig farming in developed nations produces around 25 tons of live pigs per man-year; an oyster farmer can raise 40-60 tons (shells excluded) per year. The average Danish trout farm, with 2 or 3 men, produces about 40 tons of trout a year. The sewage ponds of the Bavaria Power Co., near Munich, can produce 100 tons of carp from about 200 hectares of water. Three men tend the ponds and fish, so fish production per man-year would exceed 30 tons.

On a well-designed trout farm in Idaho, in the U. S., with enough water, one man may produce over 100 tons of fish a year; if the fish are dressed, production per man falls to 40-50 tons. The revenue per weight unit to the producer "may be reasonably compared to that derived from a weight unit of pig flesh."

Yields also depend on the organism and its position in the aquatic food chain. Algae and those animals that feed directly on the algae--molluscs, milkfish, mullet--generally produce greater yields per unit of area than species at higher trophic (nutrition) levels. This is because of their "ecologic position and their greater efficiency in creating (algae) or utilizing (herbivores) the primary products of organic synthesis."

AQUACULTURE IN A FOOD ECONOMY

It is said that aquaculture deals with luxury foods rather than staples. It is true for certain organisms and certain economic conditions (the U. S., for example). But in land-poor developed countries--Japan and, to some extent, Israel--beef is more expensive than most cultured fish. Land-poor countries, or those with soil-fertility problems and low protein supply, look to aquaculture for some staple proteins: Java with carp and milkfish culture, both Chinas with pond culture, and large parts of Africa with rapidly rising pond culture, mainly for Tilapia.

Even the bare beginning of fish culture--establishing enclosures--often leads to increased output per human unit of effort. Over 5% of Japan's total fish catch comes from coastal areas, where various fish species are allowed to enter as fry or young but cannot leave until they are harvested.

All aquaculture is done for profit, which sometimes is substantial: algae culture in Japan, oyster in Brittany, and trout and catfish in U. S. Where the operation is designed to produce more meat than the family needs, profits can be estimated. They range from 10%-15% on invested capital in low-intensity milkfish culture in Philippines to near 20% with better management in Taiwan's milkfish ponds, to 30% or more on Malayan mixed pig and fish farms. "The situation is comparable in the culturing of aquatic invertebrates."

The authors believe that aquaculture today, with a few minor exceptions, is where agriculture was 50 or more years ago. They go

on to examine the potentials for aquaculture's expansion through advances in methods and extension of area.

EXPANSION OF AQUACULTURE

Even in Japan, where it is being developed, true farming of the sea, with the exception of oyster culture, is still in its infancy. However, a trend toward rapid expansion of sea fish culture is apparent: in 1965, total production of yellowtail in Japan's Inland Sea was 65.6 thousand metric tons; over 80% of this was from cultures--net-cage-raised fish. In 1966, about 20 million young captured fish were raised in net enclosures floating in the sea, while the comparable figure in 1956 was about 200,000. Research on controlling the spawning of this species is pressed by Japanese government agencies. BCF biologists report recent successful pilot experiments with hatching and rearing of related species.

Brackish and freshwater aquaculture is more widely practiced--and also shows a wide range of production efficiencies. Raising milkfish in the Philippines now is done mostly without fertilization and/or extraneous feeding. Annual yields per hectare vary from 25 to 500 kilograms, depending mostly on soil but also on grower's efficiency. In Taiwan, with less-favorable colder climate, pond fertilization, control of competing animals such as insect larvae, and application of some extraneous food have produced annual per-hectare yield of over 2,000 kilograms.

FAO Projection

In 1966, FAO fisheries biologists examined the opportunities of upgrading management techniques as they apply to very extensive, semi-intensive, and most intensive methods of fresh and brackish water fish culture. Then they made a projection of aquacultural possibilities. Their estimates range between 5-fold and 15-20-fold increase as a possible goal to attain within the next 35 years. They believe that present average production could be raised to those levels with today's best-known fish-production techniques.

Aquaculture could be expanded by bringing into culture suitable areas not now used. No global assessment of these areas has been attempted, but FAO plans to promote it. The use of the entire potential swamp area would produce a very large yield.

The recent development of hatchery rearing techniques for invertebrates--molluscs, freshwater and marine shrimp--has opened opportunities for aquaculture in undeveloped areas. There, estuaries and coastal lands suitable for pond construction abound, but the major restraining factor is lack of organisms. "The most immediate expansion of aquaculture can be achieved by combining hatchery production with low-to-moderate intensity of cultivation practices in such regions."

As techniques improve, it becomes possible to get greater yields from less area. This is taking place in advanced, but land-poor, countries.

The catch of marine fishes has doubled (roughly) in each 10-year period since 1945. The increase was produced with much new technology and the tapping of large virgin resources: Peruvian anchovies and Soviet and Japanese fishing efforts. But ocean fishing has "finite limits," and the authors speculate that comparable large investments in aquaculture "may yield more returns per dollar more quickly than those put into the exploitation of untended stocks."

CHECKS ON AQUACULTURE'S GROWTH

The best control over an aquacultural enterprise is ownership of the area by the operator. Aquaculture also is conducted on public lands (brackish-water fish, oysters) and here leasing arrangements have to be worked out. The U. S. oyster industry, unlike the Japanese and European, is the best illustration. In the U. S., as many oysters are produced from the 185,000 acres of leased beds as from the 4 million acres of public oyster grounds. The average yield from the latter is 1/600 that of intensively cultivated leases in the U. S. and 1/5000 the average yield from Japan's Inland Sea, where all oyster-producing areas are publicly owned but privately controlled.

There are conflicting uses of public lands: for recreation, conservation, subsoil exploitation, aquaculture, etc. How the lands are used should be determined on the basis of benefit-to-cost ratios, where possible. Few such data exist for aquaculture. "The greatest need for pertinent figures exists in developing countries, but even such advanced nations as the USA do not have adequate data about the rentability of aquacultural enterprises, especially in the brackish water realm."

The problem of pollution in aquaculture falls into the same category of checks on aquaculture's development as the conflicting uses of surface areas and the supply of water. Water is a public resource needed for communities and industries--as well as for growing fish and shellfish.

In some developing countries that have aquacultural potential, the economy's private sector cannot promote this method of increasing protein supplies. Government aid is needed.

TECHNICAL CHECKS ON AQUACULTURE

An increase in aquacultural yields depends on upgrading present procedures and on more basic and applied research. To adopt the best-known practices, some legal, political, and organizational curbs must be removed. More research is needed in important areas of biology and technology. The problems of aquacultural biology can be divided into those concerning the animals and those concerning their environment.

Problems of Biology

- Animals that become captives undergo a decrease in environmental stimuli and are subjected to new ones. As a result, reproduction often is impaired. The authors state: "A thorough knowledge of the animal's biology and ecology is necessary before their reproductive functions can be manipulated satisfactorily; in most cases of semi-intensively cultured species this knowledge is not extant and should be sought."

Means should be found to bring about the simultaneous readiness for reproduction of males and females of the species. Often, males produce sperm but females will not release their eggs. Manipulating the environment has been successful here: increasing the water flow while raising or lowering temperature.

With fresh and brackish-water fish, the most important technique is hypophysation--injection or implantation of pituitary gland material from the same or related species. Extension of this work to more species, milkfish and marine species, for example, would produce useful results. U. S. scientists, because of their competence in endocrinology, "could play a strong role here."

● For the many kinds of aquatic organisms that go through several larval stages with selective food habits, an optimal, economically produced food has to be found for each species and often for each larval stage. Engineers and biologists must cooperate on this problem.

● Genetic selection and breeding of desired varieties is an important area. Presently, this approach is possible only with aquatic organisms that propagate under controlled conditions, and whose larvae or young are easy to raise. Among invertebrates, pilot-scale selective breeding has been tried with oysters and shrimp. But only carp and trout have been developed commercially into varieties. Selective breeding may soon be possible with mullet and Tilapia. Little is known about basic fish genetics; the genetics of molluscs, crustaceans, and marine algae is a virginfield. The U.S. is behind other nations in this area.

● The more intensive the aquaculture, the closer together the animals are raised. Disease organisms are transferred more readily. The study of parasite life cycles and disease prevention is an old concern of fish raisers. Most knowledge has developed about carp, trout, and oyster diseases, while parasites that attack other fishes and invertebrates are less well known. The study of parasites and diseases of aquacultural organisms is important where intensive aquaculture is practiced.

Problems of Aquacultural Ecology

● It is possible to increase the yields of water by operations comparable to the use of fertilizers, tilling, etc. Soil science is a vast field, but the amount of corresponding basic information on the interaction of pond, sea, lake, or river bottom with the overlying water is very slight.

"Practically nothing is known of the basic chemical processes that are altered or influenced when one fertilizes brackish waters. . . . Required also is research in the basic chemistry of the water--substrate interface, the circulation of nutrients, their cycles, etc."

● In aquaculture, the nutrition of the cultured animals and the fertilization of the water-substrate complex are closely related.

Improving both simultaneously brings optimal yields. But, in many cases, natural diets are incompletely known--and the digestive physiology of invertebrates and herbivorous fish has hardly been investigated. Pond-culture practices often are conducted with little understanding of what the animals are eating. Basic research in nutrition physiology should be promoted. To manufacture or obtain cheap and adequate diets may mean culturing such aquatic animals as molluscs or insect larvae--and compounding in moist or dry form plant-based, enriched, artificial diets. "Feed research for pigs, cattle and domestic fowl is incomparably more advanced than that for aquatic animals."

● A pond or sea enclosure, in contrast to a field, is a 3-dimensional growing space: some animals feed on bottom, some on plankton in midwater, and others on surface, perhaps on extraneous material. China has combined species using these different feeding habits. Other countries that tried them produced greater yields than when raising one species alone. The combined culture of fish and crustaceans also raised yields. The raft-culture of shellfish off the bottom, in a "truly 3-dimensional environment," produces much greater yields than when conventional bottom culture is practiced. These techniques can be improved.

In marine and brackish water, the cultivator must control those competing species he does not want--from insect larvae of small invertebrates to large predators. More applied research is needed here.

Technology

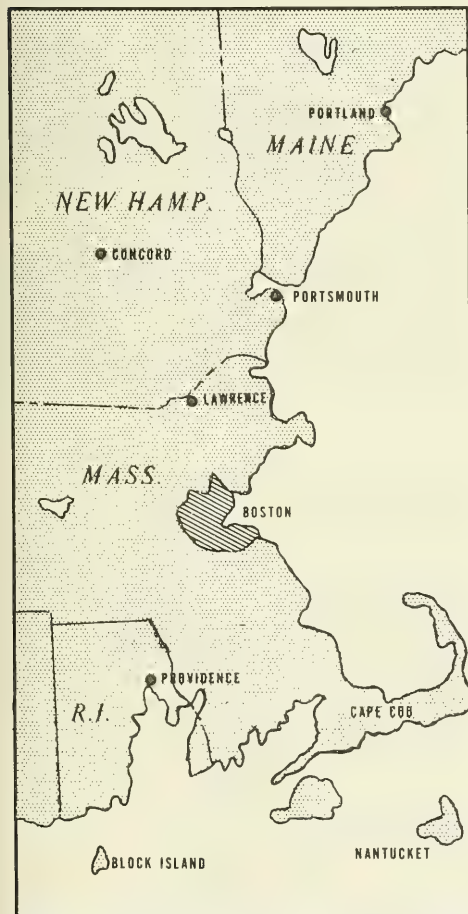
● The advanced nations have great civil engineering capabilities and experience in the economical use of labor-saving devices. These skills are needed to build fish-holding structures geared to local soil and water conditions.

Aquaculture was revolutionized by the use of machinery. Aquaculture (excepting pilot research plants) is where agriculture was before machinery was invented. Engineering design and development must be applied to aquaculture's needs. This would raise production per unit of effort--even when it did not raise yields.

OCEANOGRAPHY

Bathymetric Map of Sea Bottom Off New England Being Prepared

The most detailed bathymetric map of the sea bottom off New England is being compiled by cartographers of ESSA's Coast and Geodetic Survey (CGS). It will include the floor of Boston Harbor.



The map will cover the area from Cape Cod, Mass., to Portland, Me., and up to 53 miles seaward off Boston.

The map will cover 6,800 square statute miles of ocean bottom extending from Cape Cod, Mass., to Portland, Maine, and up to 53 miles seaward off Boston.

One of Series

It is one of a series planned by CGS for the Continental Shelf, an area about 862,000 square statute miles of submerged land off the U.S. The maps are designed to aid Federal, state, and industrial interests explore and develop the area's resources. Their economic development depends heavily on adequate sea bottom maps; few exist at present.

100 Surveys of Area

The mapping, which will take several months to complete, portrays the sea bottom at 5-meter (17-foot) intervals. The cartographers use depth data represented in more than 100 hydrographic surveys of the area conducted by the ESSA agency over 114 years. The map is expected to be released within a year.

Depths shown will range from a few feet off the coast to over 600 feet about 53 miles east of Boston. The bottom of Boston Harbor will be shown in detail for the first time.



Seek Underwater Obstructions to Delaware Bay

The Coast and Geodetic Survey has begun a two-month search for hazards to navigation in the approaches and entrance to Delaware Bay. The wire drag vessels "Rude" and "Heck," working as a team, will probe for sunken wrecks and other pinnacle-like obstructions in the heavily traveled sea lanes leading into the Bay.

Methods

The vessels will first sweep the anchorage area inside the Bay entrance, with a submerged wire towed between them, and then sweep the approach to the anchorage area and sea lanes. Rude and Heck, the only ships of

their kind, use a method perfected more than a half-century ago. The steel wire between them, suspended horizontally from surface buoys, is normally towed 35 to 60 feet below the surface. When the wire catches on an underwater obstruction, it tautens, and the surface buoys form a letter V. Exact location of the obstruction and depth over its highest point is then determined.



Search for Navigational Hazards Off Maine, N. J., Maryland

A 4-month investigation is being conducted for navigational hazards in the offshore waters of Maine, New Jersey, and Maryland by the Coast and Geodetic Survey. The task that began in August is to update current nautical charts.



Survey Alaska's Lower Cook Inlet

A hydrographic survey to aid Alaska's economic development is being carried out in Cook Inlet by the Coast and Geodetic Survey's "Pathfinder." It is being made in McNeil Cove and Bruin Bay in western Kamishak Bay, Cook Inlet.



The Pathfinder, one of the larger ocean survey vessels.

The 4-month survey will benefit the increasing marine activity and economic development of Cook Inlet, one of Alaska's important waterways.



Internal Waves Under Study

A 15-day probe of internal waves, mysterious ocean phenomena that cause unusual behavior in underwater sound, is being made by oceanographers of ESSA and the University of Washington.

Internal waves, found in all the world's oceans, are at times larger than surface waves. Internal waves 270 feet high have been measured in the Indian Ocean, while the highest surface wave ever reported was 112 feet. Sufficiently widespread to be a significant factor in many ocean processes, they may serve as "an effective mechanism for transferring energy" from the surface into the deep ocean. They may also affect underwater acoustics, communication, detection, location, and mapping.

80 Miles Off Washington

The investigation site is about 80 miles off Washington and British Columbia, where the continental shelf slopes down into the deep ocean. The oceanographers are testing a theory that some internal waves are generated by the surface tide at the end of the continental shelf. Internal waves are sometimes called internal tides.

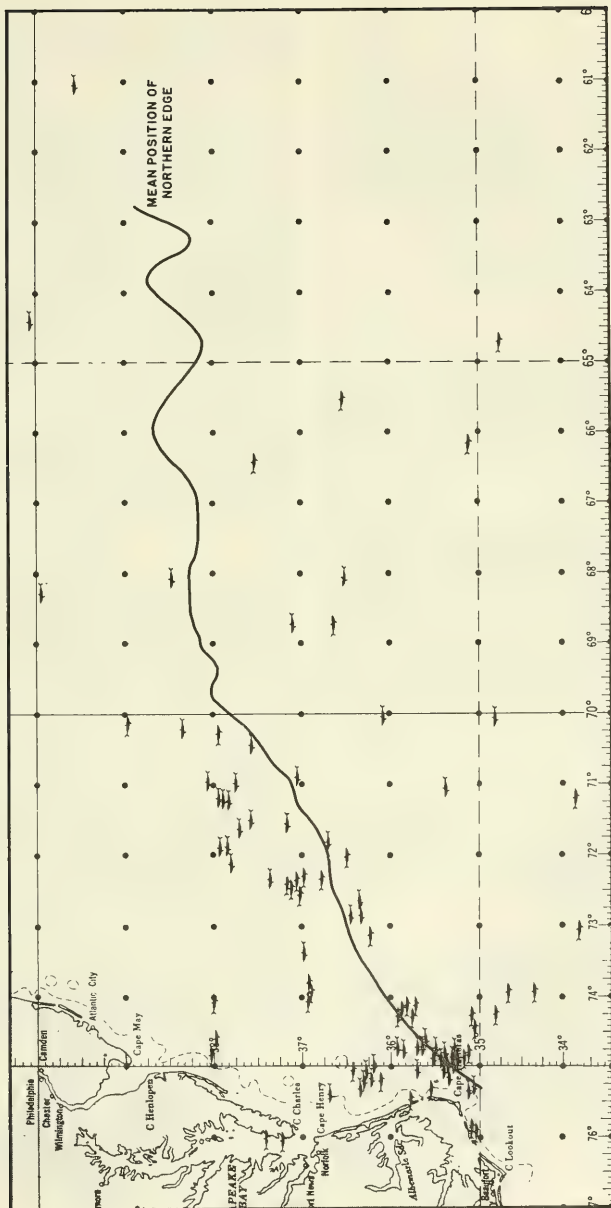


Navy Flyers Watch Sharks in Gulf Stream

Airborne oceanographers of the U. S. Naval Oceanographic Office have been watching closely the wolves of the sea--sharks--along the northern edge of the Gulf Stream. The Oceanographic Office's publication, "Gulf Stream," states: "The Navy's interest in sharks stems from the threat they pose to survival at sea. . . . In addition, sharks, or organisms upon which they prey, may interfere with underwater sound-ranging operations" used by the Navy.

From April 1966 to December 1967, the oceanographers recorded the following shark sightings:

Season	Number of Sharks	Hours Observed	Sharks Observed Per Hour
Winter (Jan., Feb., March)	45	30	1.5
Spring (April, May, June)	63	43.6	1.4
Summer (July, Aug., Sept.)	140	100	1.4
Fall (Oct., Nov., Dec.)	43	52.7	0.8



Each symbol on chart represents one sighting--usually a single shark but occasionally up to 10 or 15.

Although the shark watchers found it difficult to identify most of the sharks, they were able to recognize hammerheads by their unusual shape--and whale and basking sharks by their tremendous size. They estimated the majority of sharks ranged from 4 feet to 25 feet.



New Drift Chart

A new wind drift current computation chart has been devised by Dr. Richard W. James of Naval Oceanographic Office. The Coast Guard, which has already adopted the chart, calls it "the most recent authoritative information on wind drift currents for use in search and rescue planning."

Dr. James describes wind drift currents as those caused "by the stress of the wind on the water surface." He says that knowledge of when the currents "are to be expected and with what set and drift is valuable for many marine operations," including search and rescue operations, or any marine mission involving free-floating objects. Other marine operations, necessitating knowledge of wind drift currents, involve navigation of narrow straits or confined coastal waters and ship routing.

How Chart Works

The computation chart utilizes wind velocity in knots, fetch (the area of the sea surface) in nautical miles, and wind duration in hours. Current drift is computed in the following manner:

A 24-knot wind is forecast for a day with a fetch length of 200 nautical miles, and the wind current after 6, 12 and 18 hours is desired. Dropping vertically from 24 knots to the 6-hour duration gives a current of 0.31 knot. After 12 hours, the current has increased to 0.49 knot and by 18 hours to 0.55 knot. Use of the fetch distance instead of wind duration will also give a current in knots. Dr. James says the lower current speed is the correct one to use.

Another method is used to compensate for prior currents. The wind blows 6 hours at 12 knots and then 6 hours at 24 knots. During the first 6 hours, the 12-knot wind generates a current of 0.22 knot. A wind speed of 24 knots could create the same current in 4 hours. Adding the 4-hour duration to the 6 hours the 24-knot wind actually blows gives an effective duration of 10 hours. Using 10 hours rather than 6 hours with the 24 knots gives the correct current speed of 0.42 knot.

Because the direction of a wind drift current varies with latitude, the Coast Guard combines the chart with a deflection table. Deflection will be to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. At various latitudes, deflection will be:

LATITUDE	DEFLECTION
0 degrees to 10 degrees	None
10 degrees to 20 degrees	10 degrees
20 degrees to 60 degrees	20 degrees
Greater than 60 degrees	30 degrees



Ocean Geophysicists to Measure Movement of Magnetic Poles

U. S. Naval Oceanographic Office geophysicists are trying to determine how far the North and South Magnetic Poles have moved since the last airborne geomagnetic surveys over the Arctic and Antarctica 8 years ago.

Two flights were scheduled in September-October to investigate this natural phenomenon--movement of the magnetic poles, defined by scientists as areas, not points, where the inclination of the earth's magnetic field is 90 degrees.

On their last trip to the South Magnetic Pole, the geophysicists confirmed the existence of 2 distinct magnetic poles and the possibility of a third in the South Polar area.

The Operation

The geophysicists will use an instrument called the Vector Airborne Magnetometer to find the 90-degree inclinations that mark the

2 polar areas. The magnetometer, which measures magnetic intensity, will guide them to the North Magnetic Pole by telling the direction of true north and magnetic north.

The South Magnetic Pole produces more magnetism than the North Magnetic Pole, which since 1831 has moved from a moderately disturbed region to a relatively quiet area. The difference in magnetic intensity at the 2 poles is due, in part, to the fact that the South Magnetic Pole is closer to the center of the source of the earth's magnetic field than the North Magnetic Pole. The center is under Southeast Asia, 80 miles from the center of the earth.

The South Magnetic Polar area also generates more local magnetism than the North Magnetic Pole because the crustal rock in the southern polar area gives rise to local magnetic abnormalities. The chemical composition of crustal sedimentary rock found near the North Magnetic Pole creates less magnetism than the volcanic rock at the South Magnetic Pole.

"Because we are interested in the main magnetic field as opposed to magnetism generated by local geological characteristics, we will be flying at altitudes of 10,000 to 15,000 feet to eliminate any distortions caused by the magnetism of local rocks," the director of the Oceanographic Office's Airborne Branch said.

Poles Travel in Ellipses

Observations since 1831 at the North Magnetic Pole have caused scientists to theorize that the pole travels in a series of ellipses on its circular path around the North Geographic Pole. In the 137 years scientists have been watching the magnetic pole's movement, it has yet to complete one ellipse.

Since 1841, scientists have watched the South Magnetic Pole, which also moves in a series of ellipses around the South Geographic Pole. The circular movement of the South Magnetic Pole is exactly opposite from the path taken by the North Magnetic Pole.



Barbados Project Studies Tropical Ocean's Top Layers

Seventy scientists directed by Dr. Michael Garstang of Florida State University have completed the Barbados Project, the most ambitious study ever made of the top layers of the tropical ocean and the atmosphere above it. In this region, extending from the top layers of the ocean to the cloud layer about 2,000 feet above, much of the sun's heat, soaked up by the tropical ocean, is released into the atmosphere, powering weather systems and hurricanes moving to other latitudes.

Project Barbados Based

Barbados was chosen as a base because it is the most easterly island in the West Indies. It extends into the Atlantic across the constantly blowing trade winds, which mix latent heat, in the form of water vapor, with the air above the sea.

Methods

Using aircraft, instrument towers, tethered and free-floating balloons, ships and buoys, the meteorologists recorded temperatures, moisture, wind speed and direction, ocean currents, and cloud cover on magnetic tapes. Measurements were made along a 90-mile line, from a ship anchored 60 miles east of Barbados to a buoy anchored 15 miles west.

The data, gathered in only 3 months, will take 5 years to analyze. An even more ambitious study of the area has been scheduled for next summer; in 1970, a sea-air study will be made over portions of Florida and the Gulf.



ESSA Laboratory in Miami

The Coast and Geodetic Survey has opened the Engineering Development Laboratory, a testing facility for oceanographic systems development, in Miami, Florida. The lab, a branch of the Office of Systems Development, will support the Atlantic Oceanographic Laboratories in Miami. Both are part of the Environmental Science Services Administration (ESSA).

The lab uses satellite navigation methods to develop projects related to high-speed charting methods and buoy tracking of ocean currents. It is stationing deep-sea buoy arrays for ocean current, tide, and wave measurements, and for magnetic observations.



Underwater Camera Takes Circular Pictures

Naval Oceanographic Office divers are using a modified underwater camera to take panoramic pictures. The camera films the area a diver would see if he were rotated 350 degrees around his central location. His body prevents the camera from taking a complete 360-degree exposure.

Divers used the camera recently in North Carolina waters to test it as a surveying instrument. Panoramic pictures may help chart the ocean floor by establishing the center of a circle, and by enabling oceanographers to measure dimensions of the terrain within the circle. With distance as the known factor, a diver-surveyor can pinpoint the exact location of any submerged object in the camera's view.

The Camera

The camera, NAVSCAN LO type KE34A, is little more than a foot wide from handle to handle. It can withstand the pressure at 100-foot depths. Packed with 100 feet of 35mm ASA 400 TRI-X film, it can take 75 circular exposures. Each 350-degree negative is 0.85 of an inch wide to 14.7 inches long. The camera has an f-8 to 22 lens and a 1/150 second shutter speed.



New Diving Techniques Used in Cobb Seamount Operation

During the week of October 6-13, a Project Sea Use team carried out diving operations on Cobb Seamount, a submerged mountain 270 miles off the Washington State coast.

Diving from the research vessel "Oceanographer," the team received special mixtures of oxygen-enriched air through life lines beneath the ship. At these depths, regular compressed air would have produced "nitrogen narcosis," a loss of physical and mental capability requiring extended decompression stops for surfacing divers. Increased oxygen reduces nitrogen absorption, lengthens bottom time, and eliminates decompression stops. BCF's decompression chamber was on board, outfitted to receive the divers for recompression, and to reduce air pressure slowly enough to prevent decompression sickness or "bends."



C&GS Research Vessel Christened

The new Coast and Geodetic Survey (C&GS) vessel "Researcher," christened early in October in Toledo, Ohio, is the first of a new class of compact survey ships.

The 2,800-ton, 278-ft. ship, capable of handling helicopters, is equipped with the most highly sophisticated electronic and scientific instruments. She has an underwater bow bulb to house deep-finding transducer arrays, a 20-ton oceanographic crane designed to launch and retrieve small research submersibles, the latest navigational and weather devices, and can use satellite systems. Completely air-conditioned, she has 4,000 feet of enclosed laboratory space and accommodations for 18 scientists.

After completion, in 1969, she will conduct oceanographic surveys in the Atlantic Ocean and the Gulf of Mexico.



Foreign Fishing Off U. S. in August

NORTHWEST ATLANTIC

About 213 Soviet, Polish, East and West German fishing vessels were sighted, 32 fewer than in July.

Catches observed on all vessels were only fair. Stern trawlers land and store catch below decks quickly, reducing the chances of observing fish on deck. However, many side trawlers, which carry catch on deck until it is discharged to support vessels, have shown only limited catches. Apparently catch per unit of effort was less than in previous years. Catch was principally herring, with some small haddock, whiting, and mixed groundfish.

Soviet: An estimated 118 vessels--7 factory stern trawlers, 100 medium side trawlers, 2 factory base ships, 7 refrigerated fish transports, 1 tug, and 1 tanker--fished intensively along the 40- and 50-fathom curve around Georges Bank. In early August, large concentrations spread along the eastern slopes, but by mid-month the fleet shifted west and was northeast of Cultivator Shoals to east of Nantucket Lightship.

Polish: Thirty-five vessels were sighted fishing along the eastern and northern slopes of Georges Bank. This is about double the number reported in August 1967.

German: Twenty-nine West German and 31 East German vessels fished along the northern slopes of Georges Bank during the first 3 weeks. Late in the month, they moved to areas just off Cape Cod and Cultivator Shoals.

Romanian: The stern trawler "Galati" was sighted in mid-month for the first time this year. She had been sighted in August 1967.

During the third week in August, from 50 to 75 Soviet, Polish, East and West German vessels suddenly moved inshore to fishing grounds 12 to 20 miles southeast of Chatham, Mass., off Cape Cod. After August 23 they moved 25 to 40 miles out from the nearest point of land.

IN GULF OF MEXICO AND OFF SOUTH ATLANTIC

No foreign fishing vessels were sighted south of Cape Hatteras or off Florida. There were unconfirmed reports of a Cuban vessel long-line fishing 55-60 miles south of Grand Isle, La.

OFF CALIFORNIA

One Soviet vessel, the fishery research medium trawler "Ogon," was sighted about 17 miles west of Point Reyes.

OFF PACIFIC NORTHWEST

Forty-eight Soviet vessels, including 4 research or exploratory vessels, were sighted. The greatest effort was made in the hake fishery off Washington. Catches observed being hauled on deck varied from water hauls to 40,000 lbs. Some stern trawlers caught 50-80 metric tons a day.

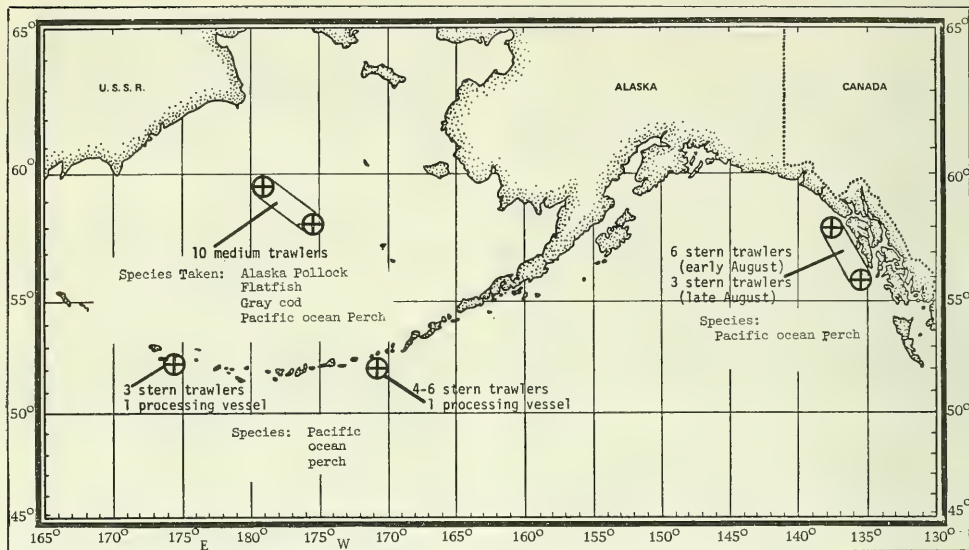
OFF ALASKA

Soviet: Between 21 and 25 fishing vessels were sighted. One processing vessel and 4-6 stern trawlers, south of central Aleutians, and 3 stern trawlers with 1 processing vessel around the Near Islands, fished for Pacific ocean perch. Ten medium trawlers fished for Alaska pollock, flatfish, Pacific ocean perch and gray cod along the Continental Shelf edge in the Bering Sea. A medium research trawler engaged in king crab research in the eastern Bering Sea. A U. S. scientist boarded the vessel for about a week in mid-August.

Japanese: The number of vessels varied between 170 and 180.

Four to 6 stern trawlers fished Pacific ocean perch in the Gulf of Alaska. Six to 18 stern trawlers fished for perch along the Aleutians. The perch fishery in the Bering Sea, along the Continental Shelf edge northwest of the Pribilofs, continued by at least 20 independent stern trawlers in early August decreased by month's end.

In the minced fish meat and fish meal fishery, 3 factoryships and 63 trawlers centered on the Continental Shelf northwest of the Pribilofs, and 2 factoryships with 37 trawlers fished on the Shelf east of Pribilofs.



Soviet fisheries off Alaska August 1968; by number of vessels and species taken.

Two king crab factoryship fleets continued fishing on the Continental Shelf, north of Port Moller, in the eastern Bering Sea. One tanner crab expedition was located about 120 miles northwest of the Pribilofs fishing conical-shaped pots set on a long line.

Two small stern trawlers began fishing on known shrimp grounds near Two-Headed Island off southwest Kodiak Island. One was observed hauling aboard a trawl containing about 2 tons of shrimp. Two Japanese vessels fished for shrimp in the same area in summer 1967.



WHAT IS THE "BENDS" AND HOW DO DIVERS BECOME AFFLICTED WITH IT?

High pressure at depth causes some of the nitrogen in a diver's body tissue to dissolve in his blood. If he ascends too rapidly, bubbles will form in the blood and collect in his joints and bone marrow, causing the extremely painful condition known as the "bends." It is not ordinarily fatal unless bubbles collect in the spinal cord or brain, but the pain will continue for several days unless the diver is put under pressure and decompressed gradually; if the condition goes untreated there will be bone damage.

After a long dive, a diver is returned to normal pressure gradually so that nitrogen in the blood may be released through the lungs, avoiding the "bends." ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

STATES

Alaska

1968 SALMON PACK DOUBLES 1967's

By Sept. 1, the 1968 Alaska canned salmon pack was 3.1 million cases--more than double the 1967 pack of 1.4 million cases for the same period, reports BCF Juneau.

Compared with the high 1966 pack of 4 million cases and 1965's 3.3 million, the 1968 pack is considered good. During the past 13 years, the pack has neared or exceeded the 3 million figure 6 times; it averaged about 2.8 million cases. The 3.1 million cases on Sept. 1 is well above the 13-year average. When the final pack figures have been tabulated, the 1968 pack may well be one of the best for this period.

Record Pinks Caught

The 19.6 million pinks caught in southeastern Alaska are more than the number caught in the 1966 season when a record 1,013,825 cases were packed. The small size of the pinks, 2.8 to 3.5 pounds, compared to a normal 4.2 to 4.4 pounds, limited the 1968 case pack as of August to 932,281 cases.

Except perhaps for Bristol Bay, BCF Juneau points out, this has been a good year everywhere in Alaska. It should bring the State back to first place among the States in value of landings and fish products produced.

Along with the increase in salmon canning is a record production of salmon caviar. BCF Juneau expects that the value of this byproduct will amount to \$16 million--and will rival or perhaps exceed the value of the total U. S.-Canadian halibut catch for 1968. Caviar production has special value because nearly all of it will be exported.



Massachusetts

NEW BOSTON FISH PIER COMPLEX PROPOSED BY PORT AUTHORITY

The Massachusetts Port Authority proposed on September 12 that a \$14.6 million Boston Pier complex be built to revitalize the city's declining fish industry. An engineering firm has prepared a feasibility study.

The Port Authority and the engineering consultants said primary causes of the decline were fragmented and old-fashioned operations and lack of understanding of the fresh fish market's potential.

Boston Near Rich Source

Edward J. King, executive director, Massachusetts Port Authority, noted that one of the richest sources of high-quality fresh fish--haddock--exists within 300 miles east of Boston. A potential \$100-million fresh-fish market in interior United States is within a day or two's drive to the west of Boston.

Study's Findings

The Fish Pier complex study, sponsored by Port Authority and the Boston Fish Market Corp., stressed the need for more efficient handling of fish from boat to display and auction areas; reduction of damage to fish during processing and handling; tighter controls on auctioneering practices; automated processing operations; consolidation of warehousing and storage facilities; elimination of truck and other traffic congestion; and more extensive use of transportation systems including air and rail; and consolidation of all fish-industry functions and operations in the fish-pier area.

Approval Needed

If the fishing industry goes along with the Authority's proposal, it will be presented to the Authority's membership for consideration.

Biologists Breed Lobsters Selectively

By John T. Hughes*

After 5 years of research and selective breeding, biologists at the Massachusetts Lobster Hatchery and Research Station, Vineyard Haven, have successfully produced albino and all red colored lobsters.

The North American lobster (Homarus americanus) normally has a dark green shell with small spots of brown, white, yellow, and red. At times rare albino lobsters are caught and also lobsters that are red, blue, or yellow. The biologists at the station believed that the odd colored lobsters could be mated with one another and some of the offspring would carry genetically the odd-color characteristics of the parents.

Early Results

Five years ago lobstermen throughout New England were asked to save all odd-colored lobsters for delivery to the research station. In spring 1965, an all-red male lobster was mated with 2 all-red females. Eggs were extruded the following summer and they hatched in 1967. (From time of copulation until the eggs hatch is about 18 months.) Approximately 50% of the newly hatched fry were all red as the parents, 25% were albino, and 25% were "normal". In spring 1966, the same red male was used to fertilize an all-

red female and a lemon-spotted female. The eggs hatched in early summer 1968. Again some of the fry produced were all red, some were albino, some yellow spotted, and some normal. These lobsters are now beyond their tenth molt and almost 2 inches in total length.

Valuable Research Tool

The biologists feel that stock from these lobsters will be very valuable as a research tool. As yet, no suitable lobster tag has been developed that will remain with a lobster after molting. Therefore, it has not been possible to follow the migrations or movements of large numbers of lobsters over a period of years. Today's tags are so large that it is necessary for a lobster to be 2 years old before it can even carry the tag. It is felt that these rare colored lobsters can be used as natural tags and studies of their movements can be started as soon as they hatch.

This initial work using selective breeding and choosing desired characteristics suggests to the Massachusetts biologists that it will be possible to choose well-proportioned, fast-growing parents to produce market-size lobsters in half the 6 years it takes in the wild.

*Director, State Lobster Hatchery and Research Station, Vineyard Haven, Mass. 02568.



Florida

ACOUSTIC SIGNALS ATTRACT FISH

"A significant breakthrough in attracting certain species of commercial fish to artificially generated acoustic signals" was announced recently by the University of Miami's Institute of Marine Sciences. The Institute stated: "It is quite possible that, in the near future, commercial fisheries can use the Institute's techniques of attracting fish, coupled with the use of bait as reinforcement, to increase their catches of certain species. This is particularly true of existing snapper and grouper fisheries in the Gulf of Mexico and Caribbean Sea areas."

Tests in Gulf Stream

Institute Professor Joseph D. Richard carried out extensive field tests. These showed clear attraction of considerable numbers of demersal predatory fish to an area, in the Gulf Stream, where a submerged sound source transmitted pulsed, low-frequency acoustic signals. The source, an acoustic projector, is mounted on the ocean floor in 20 meters of waters, about 1 mile off Bimini. Prof. Richard observed the fish through an underwater television system. Many of his field tests have been permanently recorded on video tape.

The Species Attracted

Nassau groupers, mutton snappers, margates, yellowtail snappers, yellowfin groupers, and black groupers were attracted to the acoustic stimuli. So were several unidentified species of groupers and snappers. Sharpnose sharks, reef sharks, and nurse sharks also responded.

On the other hand, herbivorous reef fishes common to the test area were not attracted.

The signals transmitted in the field tests closely simulated the natural hydrodynamic sounds previously recorded by the Institute when predatory fish were feeding. In addition to the fish inhabiting the test region, these sounds should be attractive to other species with similar feeding habits, the Institute believes.

* * *

BUILDS 'WINDOW ON THE SEA'

A new "window on the sea"--a marine laboratory to send oceanographic research vessels out to study the Gulf and Atlantic--will be opened soon by Florida State University.

At Turkey Point, 40 miles south of Tallahassee, there is a new 180-foot concrete pier. It is capable of accommodating moderate-size research vessels like the 160-foot "Petrel," already in the harbor being converted for oceanographic research. The 65-foot "Tur-siops," also being converted in the harbor, will make an initial cruise to the Yucatan Channel area this fall.

Lab Facilities

A research lab and classrooms building, shop building, superintendent's cottage and housing for 16 students will be completed shortly. The laboratory will sponsor studies in biophysics, genetics, meteorology, microbiology, and geology of the local environment and Gulf. Students will spend one day to several weeks in on-the-spot classroom and lab work.

One outstanding feature of the new laboratory is a sea water retrieval, storage, and delivery system. The water is stored in plastic tanks and touches no metal, which is toxic to living sea organisms.



Virginia

HOW TO GROW OYSTERS IN MSX AREAS

Oysters can be grown profitably in areas infested with MSX, reports Dr. Jay D. Andrews, head of the Department of Malacology at the Virginia Institute of Marine Science.

MSX is a microscopic parasite that kills many oysters but is not harmful to humans. It is a protozoan, or one-celled animal, which thrives in areas of high-salinity water. Death of oysters occurs mostly in the warm season; the winter loss is minor. MSX is now in its tenth year in Virginia with no reduction of its activity.

MSX IMMUNITY

Laboratory-bred stocks held in trays, and natural sets in MSX areas, have demonstrated that oysters can acquire immunity to the disease if exposed when young. Dr. Andrews says that survival has been consistently favorable even through drought years, which raise the salinity that makes MSX more virulent. Losses have been about 20% per year or less, not including losses from predation and smothering.

Culture Program

The following program for commercial culture in MSX areas is recommended:

- (1) Seed oysters must come from areas where MSX is active during spawning and setting period. Immunity is acquired early and remains fairly constant as oysters become larger and older. The Institute will check MSX activity in major seed areas using oysters from low-salinity, disease-free, areas.
- (2) Oysters must grow rapidly and be harvested early if they are to be raised successfully. This will involve critical decisions on time and size of seed oysters transplanted. They must be planted on firm bottoms suitable for small seed--relatively free from drill predation. Rapid growth is obtained by early transplanting (current year spat if bottom is hard) but this increases danger of predation.

Where to Buy Seed

The program is feasible if Piankatank seed oysters are available. Seed from the lower James River would be as suitable for planting in MSX-infested areas as Piankatank seed, but buy-boats buy oysters indiscriminately from tongers anywhere on the river. The risk of buying seed from up-river beds, which are not immune to MSX, is too great for planters to take.

Other Problems

Smothering, predation, Dermocystidium, and other problems--as well as MSX infection--can destroy beds of oysters. Trial planting on one bed, or involving one boatload of seed, should precede large plants in areas where MSX has decimated oysters.



Michigan

CONSERVATION COMMISSION ACTS ON SALMON

In August, the Michigan Conservation Commission increased from 3 to 6 the limit of coho and chinook salmon in a sport fisherman's possession. Fishermen still may not have more than 3 salmon in their possession while fishing or aboard boats--but they can have up to 6 salmon when ashore and not fishing.

To Sell Surplus Salmon

The Commission approved the Michigan Department of Conservation plan to sell surplus salmon for commercial purposes. High bidder for the surplus was Blackport Packing Co. of Grand Rapids. It received a contract to buy the salmon at 15.6 cents a pound.

Most of the salmon will be taken at weirs on 3 rivers tributary to Lake Michigan. Sale money will go to Michigan's Game and Fish Protection Fund.



Oregon

DISEASES HIT SPRING CHINOOK

The Oregon Fish Commission reported on September 6 that spring chinook salmon in adult holding ponds on the Middle Fork Willamette were being attacked by several serious diseases. Pathologists isolated and identified *Ceratomyxa*, *Henneguya*, columnaris, furunculosis and kidney disease. Each disease alone can be serious; combined, they caused large-scale mortality.

Death Rate Rose

Only 1 or 2 fish a day died in late June, but the death rate later increased to 100 a day. Over 2,500 salmon had died by September. More than 10,000 big chinook, almost one-third the Willamette Falls escapement, were estimated to be in the holding ponds, or waiting to get in from the river immediately below Dexter Dam.

Ponds Chemically Treated

Commission pathologists began treating the ponds 3 times a week with a chemical that reduces the effects of columnaris and fights

the spread of external fungus. The treatment was largely a holding action because there are no specific cures for some of the diseases-- and no facilities to handle the mass of fish involved.

Past efforts to develop drugs and chemicals to control disease, and to administer medication on a large scale, have been hampered by lack of funds, specialized equipment, and facilities to take care of large numbers of adult salmon. Several serious diseases have been eliminated or minimized in hatchery-reared juvenile salmon by adding medication to hatchery feed. Use of oral medications at Dexter is impractical because adult salmon generally do not eat after leaving the ocean and entering fresh water. In the future, biologists hope to develop serums that can be incorporated into hatchery feed to immunize small fish against major adult diseases.

Many Fish Return

Despite the high mortalities, large numbers of returning fish guarantee sufficient eggs for hatchery operations. Increasing numbers of adult spring chinook have returned to the holding ponds in recent years. In 1960, only 800 fish returned, but more than 10,000 returned in 1967 and in 1968.

The two holding ponds and the Willamette Hatchery, 30 miles upstream, compensate for fish losses caused by Dexter and Lookout Point Dams. The dams, built without fish passage facilities, block all anadromous fish from the Upper Middle Fork Willamette. Returning adults are collected in the ponds at the base of Dexter Dam and held until maturity. The eggs are taken, fertilized, and transferred to the hatchery for incubation and rearing. The small fish are trucked back and released below Dexter Dam.

* * *

OPENS NEW SPAWNING AREA

The construction of a fish ladder at Valsetz Dam makes available to Siletz River salmon and steelhead 30 miles of new spawning grounds this fall. The dam on the South Fork of the Siletz, about 72 river miles from the ocean, was built in the 1920s, without fish-passage facilities. Since 1950, when an impassable falls about 7 miles downstream was laddered, it blocked upstream fish passage. The fish ladder should be completed in time to pass coho and winter steelhead this year.

In 1964 and 1965, hatchery surplus adult steelhead, and coho fingerlings and adults, were released above the dam. Later, spawning-ground surveys, and trapping of downstream migrants at the dam, confirmed a belief that the area had excellent natural production potential.

Valsetz Latest In Program

The Valsetz Dam fish ladder is the latest project in a program begun in 1965 to provide adequate fish passage at every dam on Oregon salmon and steelhead streams. Fish passage has been improved or established on more than 840 miles of stream so far. New fishways have been built, old ones improved, and dams removed at 40 different sites throughout the state. Total natural salmon and steelhead production from these areas should add 50,000 chinook, coho, and steelhead annually to sport and commercial catches.



California

ACTS TO PROTECT KING SALMON

In August, the California Fish and Game Commission adopted a 3-point emergency program to protect the declining fall run of king salmon in the Central Valley.

The bag limit was reduced from 3 to 1 salmon on major streams in the Central Valley from Sept. 1 through Dec. 31. The streams include the Sacramento, San Joaquin, American, Feather, Merced, Mokelumne, Napa, Stanislaus, Tuolumne, and Yuba rivers and Elder, Putah, Stony, and Thomes creeks.

The spawning closure on the Sacramento River was extended from Keswick Dam to the Red Bluff Diversion Dam from Sept. 1 through Dec. 31.

The 3-mile stretch of the Sacramento River from the Highway 99 Bridge downstream to the Cypress Street (Old Highway 44) Bridge in Redding was closed to all fishing year round.

Ocean Catch Down

The ocean catch of king salmon has declined steadily from about 800,000 in 1964 to 400,000 in 1967. The fall run of salmon returning to spawn in the Central Valley dropped from 300,000 to 175,000 in the same period.

* * *

1968/69 ANCHOVY REDUCTION FISHERY QUOTA SET

The California Fish and Game Commission has set a 75,000-ton quota for the 1968/69 anchovy reduction fishery, the same as the past 3 seasons. The season for the northern permit area opened August 1 will close May 15, 1969, and the area quota remains 10,000 tons.

Southern Area

The season for the southern permit area's 5 zones will be Sept. 15-May 15. Each of 4 inshore zones will have a 5,000-ton quota; the offshore zone has 45,000 tons.

If the quota for either permit area is reached, the Commission will consider increasing the quota for that area. Last season, there was no fishing in one zone and light effort in several others. Landings of anchovy for reduction were 6,505 tons for the 1967/68 season.

The anchovy population in California waters is estimated at a minimum of 2 million tons.



Texas

TOXIC ALGAE KILLS HATCHERY CATFISH

The killer of fish in ponds of the Parks and Wildlife Department's hatchery at Sheldon, northeast of Houston, has been discovered and controlled after 2 destructive years. It was one of the toxic blue-green algae of the genus Anabaena.

A school of fry (baby fish less than 2 inches long) would be alive and healthy--and the next minute, hundreds would be dead. In summer 1967, only a few fish were killed, but in 1968 the loss ran into thousands. The hatchery production of catfish seemed seriously affected.

Cause Discovered

Two hatchery men watching a large school of baby catfish fry gulping their way through the water saw them feed on microscopic bits of food on the surface. The fry's route took them into blue-green scum. Immediately,

hundreds of the little fish showed signs of distress and died. The green scum, an algae, was the killer.

Hot weather had caused the algae to "bloom," rise to the surface, and form scum. Ironically, the care hatchery fish receive added to their mortality. Small catfish in hatcheries are accustomed to feeding on the surface. Their diet is supplemented with finely ground food scattered on the water. The fish had mistaken the toxic algae (few algae are toxic) for food.

Once identified, chemical control of the plant is simple. Catfish farmers should look for the phenomenon in their hatcheries, advises the Texas Parks and Wildlife Department.



There are 1,356.5 acres of water in Texas being used for catfish cultivation. These should produce an estimated 3,694 tons of fish in 1968.



Commonwealth of Puerto Rico Receives Former BCF Lab

In 1941, the University of Puerto Rico gave BCF 2 acres of land on which to build a \$25,000 fishery research laboratory. Since 1948, when BCF personnel were withdrawn, the lab has served the university's marine-biology program. The lab was declared surplus government property and recently was donated to the university.

The BCF lab had sought better methods of using available species and taught refrigeration and marketing techniques. Some exploration for pelagic species, such as tuna and mackerel, was done.

Puerto Rican Industry

Puerto Ricans eat much more fish than is available from the immediate vicinity. Abundance of fish is limited because the island, peak of a high ocean mountain, lacks the "shelf" formation that provides fishing grounds for most coastal areas.

There are 4 tuna canneries on the island. Most of the tuna is caught in the tropical Pacific, transported through the Panama Canal, and landed at Puerto Rico for processing.



BUREAU OF COMMERCIAL FISHERIES PROGRAMS

Thread Herring Reared in Miami Lab

For the first time, the "thread" herring (*Opisthonema oglinum*) has been reared from egg through juvenile stages in a marine laboratory. This was achieved in BCF's Miami Tropical Atlantic Biological Laboratory (TABL).

According to Laboratory Director Dr. Carl J. Sindermann, research scientists there strove for many months to devise means of nurturing pelagic (open-sea) fish native to tropical Atlantic waters, under artificial circumstances, from egg to healthy adult. Their work with the thread herring proved a shining success.

The silvery, compressed fish is plentiful in the waters around the southeast U. S. It is considered a good source of fish meal and a potential source of fish protein concentrate (FPC). It is called thread herring because of a long, slender filament that extends back from the dorsal fin almost to the tail.

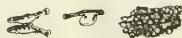
The Operation

Dr. Sindermann said it was the first time marine biologists had been able to identify the thread herring in its larval stage (between egg and almost fully formed juvenile).

The 300 eggs measuring about 1 millimeter each that began the project were caught in the Gulf Stream by plankton sampler manned by laboratory scientists Dr. William J. Richards and Barbara Palko. The eggs were transferred to a TABL aquarium containing water from the site of capture. Two days later, they hatched into the larval stage: tiny creatures about 4 millimeters long. The third day after capture, the larval fish began to feed on plankton gathered from nearby Biscayne Bay. Water temperature was maintained at 80° F. throughout the experiment.

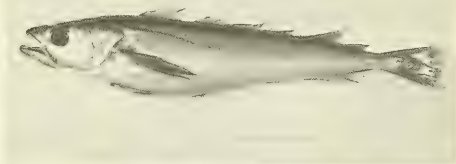
Within 30 days, the larvae had developed into juvenile fish 1 to 2 inches long--big enough for biologists to be sure of the species. Survival rates are considered excellent at 30 to 40 percent of the original 300 eggs, or well over 100 healthy thread herring. The survivors are expected to reach their normal size of 8 to 10 inches.

The TABL scientists say that although a number of freshwater species of fish have been cultured from egg to maturity, each successful rearing of a marine fish represents a rare and significant achievement.



Genetic Variants Point to Isolated Populations of Pacific Hake

"Studies on genetic variants in Pacific hake (*Merluccius productus*) strongly support the hypothesis that there are at least two distinct and isolated populations--one in Puget Sound and another off the coasts of Washington, Oregon, and California." This was reported by Rae R. Mitsuoka, writer-editor, BCF Biological Laboratory, Seattle, Wash.



Pacific Hake (gauge = 15 cm.).

He disclosed: "Puget Sound hake are generally smaller (average, 35 cm.) than those in coastal waters (average, 50 cm.). The otoliths, or ear bones, of the two populations also vary. It is more difficult to assign ages to hake from Puget Sound because the annular zones are more irregular (although this difference may not necessarily be a function of the smaller size). Hake of oceanic size have occasionally been caught in Puget Sound, which raised the question of whether the larger fish were migratory or indigenous.

"Two enzyme systems, which directly reflect basic genetic differences of hake, were studied. These systems included esterase variants in the eye fluids and lactate dehydrogenase (LDH) variants in extracts of liver tissue.

"The gene frequencies of the large and normal fish in Puget Sound agreed with those of smaller fish from the same area. This

indicated that the larger fish are indigenous to Puget Sound. It is interesting that all the large hake caught in Puget Sound were females, which are larger at maturity than males."

The genetic studies were conducted by his colleague, Fred M. Utter.



55,000 Fur Seals Harvested on Pribilofs

The harvest of fur seals on the Pribilof Islands through August 13 was about 55,000; 45,000 males and 10,000 females. The harvest of males ended August 13; that of females continued through August 19 until the quota of 13,000 was reached.

Below 1967 & Prediction

The male harvest was 10,000 below 1967's and 5,000 below prediction.



Harvesting Catfish in Hot Weather

Continued progress on safe harvesting of live catfish from farm ponds during hot summer months resulted from experiments at the BCF Exploratory Fishing Station, Kelso, Ark.

A floating 300-gallon-per-minute pump was used to circulate water through catches in a fish bag during seining operations. Four catches, ranging from 3,000 to 10,000 pounds each, were successfully handled even when water temperatures exceeded 90° Fahrenheit.



BCF's Fast-Sinking Tuna Purse Seine Catches Elusive School

BCF's experimental fast-sinking purse seine, fished by the "Liberty" in the Pacific, took 30 tons of bonito in one set. This followed unsuccessful attempts by 2 other vessels using conventional seines to catch the school.



'Hero' Conducts Fishing Gear Trials

The new National Science Foundation (NSF) vessel Hero left the Washington, D. C., Navy Yard on Sept. 10 to carry out fishing-gear trials while en route to Miami, Fla.

The Hero is a 125-foot, diesel-powered but sail-equipped, wooden ship built for research in Antarctic waters. BCF's Seattle (Wash.) Exploratory Fishing and Gear Research Base recently received an NSF grant to conduct surveys of midwater and demersal (bottom dwelling) species from the Hero in the Antarctic. The Seattle staff will begin to participate in the Antarctic program in April-May 1969.

Seattle Aids Hero

Before the Hero left Washington, Miles Alton and Ian Ellis of the Seattle Base installed midwater trawl gear and depth-telemetry equipment. They accompanied the vessel to Miami to handle any problems.



Vacuum-Stern Thawing of Frozen Fish Is Tested

Scientists of the BCF Gloucester (Mass.) Technological Laboratory recently tested the vacuum-steam thawing process for rapidly thawing blocks of frozen fish. They were permitted to use the test facilities of the Croll-Reynolds Company in New Jersey.

In one test, the internal temperature of a frozen and glazed block of shrimp was raised from the low 20s F. to about 65°-70° F. by exposing the shrimp to a 10-second burst of steam under vacuum. Almost all ice was removed; the individual shrimp were separated very easily.

Process Has Good Potential

The researchers believe these results show the good potential of the process for the shrimp industry--and suggest that the possible usefulness of the process to the tuna industry be investigated.

Vacuum-steam thawing has these advantages: thawing is achieved very quickly because it takes place in a vacuum; oxidation

problems are almost eliminated; weight losses are minimal because thawing occurs in a moist atmosphere; bacteriologic problems of water thawing are eliminated; heat damage to the product is minimal.



Controlled Atmosphere Shipment of Fresh Fish Studied

BCF Technological Laboratories at Ann Arbor, Mich., and Seattle, Wash., have conducted research on the use of controlled atmosphere to extend the shelf life of fresh fish. Preliminary tests showed that fresh salmon can be kept under refrigeration for 20 days in a controlled-atmosphere container without spoiling.

To evaluate the benefits of this new preservation method, BCF staff is working with Transfresh Corp. on a trial shipment of fresh silver salmon by truck to a Washington, D. C., retail chain.

Truck shipments using controlled-atmosphere containers and refrigeration may offer an alternative to the more expensive air shipments.



Fresh Coastal Fishery Products Flown to Midwest

BCF's marketing staff helped to increase the amount of fresh coastal species airshipped into U. S. Midwest markets this summer. Food chains in Minneapolis, Minn., and Cleveland, Ohio, were the latest to introduce fresh fishery products.

One chain sold over 40,000 pounds of silver salmon in a short period. Another sold 6,000 pounds of fresh halibut and salmon this summer; last year it successfully introduced fresh rainbow trout.

Planes flying to the Midwest from the coasts are developing delivery "routes" for fishery products--and servicing retailers in Milwaukee, Wisc., and Minneapolis on the same flight.



Plankton Workshop Held at La Jolla

Scientists from BCF labs, the Bureau of Sport Fisheries & Wildlife, and the Scripps Institution of Oceanography took part in a BCF-sponsored Plankton Workshop at the Bureau's Fishery-Oceanography Center at LaJolla, Calif., in late July.

They discussed problems of accuracy, such as extrusion of plankton through the mesh of a net, avoidance of nets, effect of patchy plankton distribution on sampling precision, and experiences in such large cooperative surveys as EASTROPAC (Eastern Tropical Pacific program).

Plankton Survey Effectiveness

They showed much interest in the effectiveness of plankton surveys in evaluating distribution and spawning intensity of commercially valuable fish stocks.

Plankton voluming and sorting, data analysis, larval fish identification, netting, and new approaches to plankton sorting and collection were demonstrated.



Miami Lab Releases More Drift Bottles

Thirty-six hundred empty beer bottles, inanimate researchers in a study of surface current patterns in the tropical Atlantic and Caribbean, were released by BCF's R/V "Undaunted" as she steamed to Africa last August. The bottles were donated to the BCF Tropical Atlantic Biological Laboratory (TABL) by the Miller Brewing Co. of Milwaukee.

During 1967, almost 5,000 drift bottles from a previous donation were released in and around the Florida Straits, Caribbean, and in the eastern tropical Atlantic off Africa. Five hundred and eighty-two were recovered--an overall return of 13%. Some areas yielded a 58% return.

Each bottle contains sand for ballast and a fluorescent, bright-orange card printed with a message in Spanish, French, Portuguese, and English. The message asks finder to fill in details about his discovery on an attached postcard addressed to TABL. TABL thanks

the finder, sends him a small chart showing track the bottle might have followed, and a cookbook of fish recipes in Spanish and English.

Finders Send Personal Messages

Many finders send personal messages. An ex-school teacher from Guyana was irate when he did not receive "a special reward like even a small outboard engine;" a fisherman from St. Jean du Sud Island requested "things necessary to subsidize my needs for fishing," and added: "I expect you will make me a researcher;" a Bahamian wrote that he had borrowed postage money and asked for "a pocket full" in return; still another expected a transistor radio.

A poignant communication in Spanish came from San Blas: "I saw a bottle which contained a card and also dry sand. The sand had some particles which sparkled and the sparkles of sand and the card inside frightened me. I bent over and seized the bottle; I wanted to show it We began to open the bottle and take out the card, but we did not want to touch the sand because we were afraid of the glistening particles. The card is wrinkled because we could not take it out. Please excuse us for that."



Lobster Tagging Study Off New England

Scientists of BCF's Biological Laboratory at Boothbay Harbor, Maine, have tagged over 2,000 lobsters off the southern New England coast. Their purpose is to learn about migration, growth, and survival of deep-sea lobsters--and their relationship, if any, with native coastal stocks.

30 Recaptured

Commercial fishermen have caught 30 tagged lobsters. Several lobsters had made long shoreward migrations: one covered 97 miles of ocean bottom in 27 days; another--an egg-bearing female--traveled 77 miles in 28 days.



'National Geographic' Features Research of Auke Bay Lab

The research of BCF's Biological Laboratory at Auke Bay, Alaska, was a major theme in the article on salmon appearing in the August issue of the National Geographic magazine.

Photos included pink salmon spawning at Little Port Walter, Alaska, micro-wire tagging and fluorescent pigment marking of fry at Traitor's Cove, Alaska, and tracing migration of pink and chum salmon at Olsen Bay, Alaska.



Attraction of Herring to Artificial Lights Studied

Biologists at BCF's Boothbay Harbor (Maine) Biological Laboratory have completed studies on the attraction of herring to artificial lights. Repeated experiments have confirmed that attraction increases at lower temperatures, lights are more effective below the surface than above, and optimum light intensity is greater below.

Prior Adaptation

The effect of prior adaptation on response is still uncertain. Although previous experiments indicated that prior adaptation to darkness produced a weaker response than prior adaptation to light, differences were not significant, and the experiments are being repeated.

Feeding Habits of Herring

Other studies at the lab have shown that herring feed on herring. Larval herring remains were found in the alimentary tracts of 46% of the adult herring samples collected this summer. Continued sampling will enable researchers to estimate the frequency at which the adults prey on their young.



'Delaware's' Gloucester Trawl Catches Exceed Commercial Catches

The primary objective of the BCF Delaware's August cruise was to measure openings and other factors in 3 models of the Gloucester trawl under actual fishing conditions in 35 to 100 fathoms. (Cruise 68-7, Aug. 13-22.) A secondary objective was to take similar data on a #36 trawl for BCF's Biological Laboratory at Woods Hole, Mass.

Twenty tows of various duration were made in the Bay of Fundy area, mostly where New England based trawlers were fishing. The researchers used 3 sizes of the BCF Gloucester trawl developed at the Exploratory Fishing and Gear Research Base, Gloucester, Mass. One tow was made off Cape Ann, Mass., with a manila #36 trawl. The Delaware's catches were equal or superior to the catches of the commercial vessels.

Gloucester Trawls

The 3 sizes of Gloucester trawls fished and measured were: (1) an 88-foot headrope, 100-foot footrope trawl with $4\frac{1}{2}$ -inch mesh throughout the net, (2) an 86-foot headrope, 106-foot footrope trawl with 6-inch mesh in wings and square and $4\frac{1}{2}$ -inch mesh in remainder of the trawl, and (3) a 106-foot headrope, 128-foot footrope trawl with 6-inch mesh in wings and square and $4\frac{1}{2}$ -inch mesh in remainder of the trawl. Trawl number 3 was made up and measured in anticipation of its use aboard the new stern trawler research vessel "Delaware II." All these trawls used the same set of rubber roller gear. This gear was made up of discs and 18-inch wing rollers in the wings and 22-inch rollers in the bosom (see illustration).

Results

Trawl net factors in the 4 trawls used were:

Trawl Net Measurements Under Tow

Net	Footrope	Wing End	Headrope Height	Wing Spread
A	100'	12'	17'	50'
B	106'	13'	16'	48'
C	128'	6'	27'	40'
D	#36 trawl	6'	6'	41'

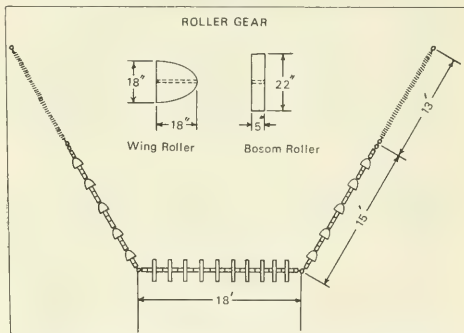
Notes: (1) Figures shown are averages from all data collected on each trawl.

(2) Data collected on Net B were influenced by numerous changes to trawl and rigging. The lack of a wing end height for net C was due to damage to wing end transducer.

The figures given are those recorded when the net had settled down and was being towed in a straight line. Over the years, trawl

instrumentation activities at the BCF Gloucester base have resulted in compilation of many readings on various trawl nets. With few exceptions, it has been found that trawls require time to settle down before reasonably steady readings occur; also, that tides, rough seas, and types of bottom towed over are factors that affect trawls.

The researchers report that use of the wing end transducer sounding downward indicates that the Gloucester trawls offer a considerable wing end height. This has 2 obvious advantages: (1) the fish-herding effect of a wing is acting at a far greater height off the bottom, and (2) the possibility of a headrope hangup is reduced considerably. This was demonstrated on a previous trip. At that time, with the vertical wing-end transducer on the wing, a Gloucester trawl was towed up a precipitous ridge from 94 to 62 fathoms depth. The wing end was 14 feet off the bottom at the start of the climb. This height diminished to 4 feet before the trawl climbed over the ridge. Had the #36 trawl with its 6-foot wing end height been towed over this ridge, it is reasonable to believe that the headrope would have touched bottom.



Roller gear used on Gloucester trawl; Delaware Cruise 68-7.

Advantages of Trawl's Opening

The trawl achieves a higher opening. At the same time, other fishing characteristics, such as bottom contact and wing spread, remain constant--or comparable to a standard trawl. Obviously, the trawl should take better catches of groundfish species, such as cod, pollock, haddock, and others that sometimes swim up off the bottom. Fishing results of the Delaware's Cruise 68-7 bear out this advantage. To compare catch rates, tows 1

through 13 were made in an area in which commercial trawlers were operating. During these tows, catches of the Delaware always equaled or exceeded catches of commercial vessels, although the Delaware's tows were much shorter. Tows 14 through 20 were not made in company with commercial trawlers but on grounds where fish apparently were much less abundant.

There was no incident of damage to the gear under tow during the entire cruise. Reports of damage among the trawlers were heard over the radiotelephone. The results of this cruise and Cruise 68-2 suggest the roller rig used (illustrated on page 29) is more effective at reducing damage than the standard wooden rollers. More trials with this gear will be undertaken.

Note: For additional information, contact Keith A. Smith, Base Director, or Robert A. Bruce, Fishery Methods and Equipment Specialist, EF&GR Base, State Fish Pier, Gloucester, Mass., 01930, Telephone: 617-283-6554.



'Rorqual' Studies Post-Metamorphosed Herring and Their Environment

BCF's Rorqual cruised the waters from Cape Ann, Mass., to Eastport, Maine, to determine the relative abundance and distribution of post-metamorphosed herring (brit 3'') and to sample their environment. (Cruise 7-68, 8/7-8/22.)

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

Preliminary Findings

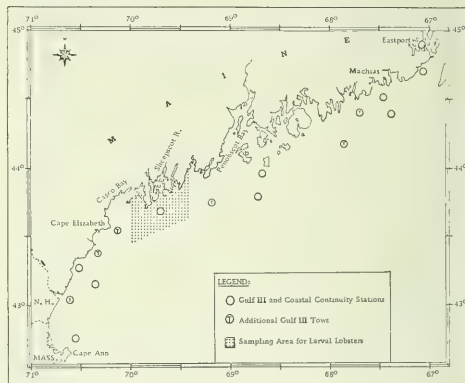
Medium-to-heavy surface traces were observed only from Penobscot Bay to Petit Manan. These traces were particularly heavy around the headlands from Dyer Bay to Mount Desert. From Penobscot Bay to Casco Bay, the traces were light and scattered. Repeated tows through the waters where the traces occurred failed to take any fish.



'Rorqual' Checks Distribution of Larval Lobsters Off New England

The Rorqual investigated the distribution of larval lobsters and other zooplankton in the waters from Cape Ann, Mass., to Eastport, Maine. (Cruise 6-68, 7/17-8/6.)

During Phase 1 (July 17-26), a 2x1m neuston net was towed to collect lobster larvae at the surface for 30 minutes in the area shown on the chart.



R/V Rorqual Cruise 6-68, July 17-Aug. 6, 1968.

During Phase 2 (July 29-Aug. 6), oblique tows were made simultaneously from 0 to 20m for 30 minutes. The researchers used paired bongo nets (0.03 mouth area) and a Gulf III sampler at 10 coastal continuity stations-- and at 6 other stations shown on the chart. Neuston tows also were made at each sampling location.

Preliminary Findings

During Phase 1, 65 lobster larvae were collected on 3 inshore-offshore transects sampled off Casco Bay, Boothbay Harbor, and Muscongus Bay. Most of the larvae, 57 or 88%, were in the first larval stage; 8 were in the second stage. First-stage larvae were widely distributed; second-stage larvae occurred only offshore. The catch-per-tow of larvae decreased from inshore to offshore in a distribution pattern that suggests inshore origin. The catch of larvae in the neuston tows made along the outer coastal area, from Cape Ann to Eastport, was limited to four stage one specimens.

Zooplankton standing crop in summer decreased to 2.28 cc/100m³ (of water strained) from the preceding spring mean of 8.92 cc/100m³. The greatest decrease was in the western area. Volumes in the central and eastern Gulf coast were not significantly different from the spring values. In previous summers, volumes generally decreased from west to east. During the cruise, however, zooplankton volumes among the 3 areas sampled were not significantly different.

U. S.-USSR Cooperation

As part of the U. S.-USSR cooperative investigation of plankton sampling methods, comparisons were made between the catching efficiencies of the Gulf III sampler and paired bongo nets (0.03 mouth area) used during the cruise. In 9 of 10 simultaneous tows made with the samplers, the bongos collected more zooplankton. The smaller zooplankters apparently were extruded through the rigid meshes of the Gulf III. The smaller copepod species--*Pseudocalanus minutus*, *Acartia* sp., and *Centropages hamatus*--were 5 to 30 times more numerous in the bongos. Catches of the larger copepods, particularly *Calanus finmarchicus*, were similar in the 2 samplers.



'Cobb' Tests Shrimp Trawl Separator

BCF's John N. Cobb cruised for 26 days off Oregon testing shrimp trawls equipped with experimental devices for separating shrimp, *Pandalus jordani*, from other bottom-dwelling invertebrates and from fish. (Cruise 96, ended 8/2.)

Gear

Basic gear was two 57-foot headrope length semiballoon shrimp trawls having 2-inch stretch mesh webbing. Some tows were made using a shrimp try net with a panel of 3-inch web separating the trawl into upper and lower sections.

Methods

Scuba-equipped gear specialists observed the trawls in operation and determined trawl configuration for various modifications.

In several experiments, various portions of the trawls were covered with lightweight

$\frac{3}{4}$ -inch mesh web to determine escapement of shrimp and fish through the larger trawl web. Later, large areas of the trawl were covered with $\frac{3}{4}$ -inch web and the catch was isolated from the main trawl codend.

Comparative tows between 2 trawls were made simultaneously by joining one wing of each trawl and towing from a 3-warp system. The vessel trawl net reel was equipped with tow cable to pull the common center wing.

An Oregon Fish Commission biologist gathered data on size, age, and sex composition of shrimp retained in various experimental net configurations.

Results

Experiment 1: Exterior liners of $\frac{3}{4}$ -inch mesh web, attached along each side panel of trawl from wings to intermediate, retained shrimp and fish that normally escaped through that part. Of the total catch made during 4 tows, 60% of the shrimp were retained in the liner codend after passing through the 2-inch mesh trawl. Only 4% of the fish and invertebrates passed through to exterior section. Average proportion of age 1 shrimp was 0.7% in trawl codend and 4.8% in exterior liner.

Exp. 2: An exterior liner of $\frac{3}{4}$ -inch mesh web placed over top panel of trawl and aft to codend indicated that shrimp also passed through the top of trawl. Of total shrimp catch made during 10 tows, 29% were retained in the liner codend after passing through 2-inch top portion of trawl. Eulachon, *Thaleichthys pacificus*, was the dominant species in the liner catch and comprised 2% of total fish and trash catch.

Exp. 3: Four tows were made with a 2-inch mesh trawl completely enclosed, with the exception of the trawl belly, in a series of exterior $\frac{3}{4}$ -inch mesh covers. Riblines added to trawl side seams allowed side panel meshes to open fully so shrimp could pass through and be separated from remainder of the catch. Ninety-three percent of the shrimp captured did pass through the 2-inch trawl web and were retained by the external covers.

Exp. 4: A small Gulf-of-Mexico-type try net, which incorporated a horizontal 3-inch mesh web panel to separate upper and lower parts of the trawl, successfully restricted nearly all trash species to bottom portion of trawl. Unfortunately, although most unwanted

species were separated, only about 17% of the shrimp passed through the separator panel into the top section.

Exp. 5: A dual net trawling technique was tested that permitted an experimental net to be fished simultaneously with a control net. It was necessary to use more tow cable than when towing a single trawl to hold the center wings at the ocean floor. The two 57-foot shrimp trawls covered a path about 45 feet wide; a single trawl covered only a 25-foot path. Both trawls were wound onto a single trawl net reel.

Results

The experiments provided useful information for effective trawl design. None of trawl configurations tested was intended to operate as a commercial net. However, 2 prototype commercial trawls were constructed following cruise that used the experiment results. These trawls will be tested during Cobb Cruise No. 97.

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



'Commando' Evaluates Mark II Universal Trawl

The BCF chartered research vessel *Commando* conducted a 17-day study in the coastal waters of Washington and northern Oregon in cooperation with the Atomic Energy Commission. (Cruise 15, ended 6/30.)

Cruise objectives were to (1) evaluate the Mark II Universal trawl for sampling off-bottom fish populations; (2) determine relative distribution of midwater biomass (amount of living matter) in relation to sound-scattering layers; (3) assess feasibility of using a drone to increase efficiency of searching for midwater fish schools.

Gear

Fish populations were sampled with a Mark II Universal trawl. This net has a 94-ft. headrope and footrope. It was rigged with 41 floats equally spaced on the headrope, and $\frac{1}{2}$ - and $\frac{3}{8}$ -inch chain on the footrope. The forward part of the net was 5-inch polyethylene web with intermediate and codend sections of

$3\frac{1}{2}$ -inch mesh polyethylene web. The codend was completely lined with $1\frac{1}{8}$ -inch mesh. All tows were made using 5-ft. by 9-ft. aluminum V-doors weighing about 675 pounds each. Three-leg, 30-fathom bridles attached the doors to the net. The gear was towed with $\frac{5}{8}$ -inch diameter electromechanical cables. Pressure-sensitive depth-telemetry equipment was used to determine depth of fishing.

A 6-foot Isaac-Kidd trawl was used to sample nekton. Body and intermediate sections of the net were $3\frac{1}{2}$ -inch mesh webbing, lined with $\frac{1}{8}$ -inch mesh nylon netting; codend was $\frac{1}{8}$ -inch mesh nylon netting.

The 23-ft. auxiliary research vessel "Sea Probe" was used to determine the feasibility of scouting for fish using a small vessel. This vessel worked with *Commando* during fishing trials and was equipped with a radio-telephone and a 200-fathom sounder having a fish-discrimination feature.

Method of Operation

A survey was conducted in the offshore area from Cape Flattery, Wash., to Tillamook Head, Ore., from nearshore to 30 miles off the coast. The area contiguous to the Columbia River mouth was emphasized. All fishing was conducted in less than 75 fathoms.

Fish were located by offshore-inshore sounding transects. When scattering layers were recorded by the high resolution, low-frequency echosounder, they were fished with Universal and Isaac-Kidd trawls to determine their composition. Trawl hauls also were made above and below sound-scattering layers appearing on the echograms to ascertain availability of fauna at these depths.

Towing speed for the Universal trawl ranged from 2.5 to 3 knots and for Isaac-Kidd trawl from 5 to 6 knots. Twenty-six Universal and 9 Isaac-Kidd trawl hauls were made during cruise at depths to 62 fathoms.

Evaluation of the Mark II Universal Trawl

The trawl was rigged with 31 floats and fished in 10 fathoms at 2.1 knots. Scuba-equipped divers determined the trawl's vertical opening as 22 to 24 feet at the wingtips and 27 to 28 feet at the center of the net. Tension was about 2,000 pounds on each warp. The aluminum V-doors performed satisfactorily; because weight was concentrated in the

shoe, doors were very stable when fished both on- and off-bottom. The net tended bottom well during the tow but, because of the disproportionate weight of chain on the footrope, 10 more floats were added to lighten the trawl.

Mark II Universal trawl fished on- and off-bottom fish populations satisfactorily. Groundfish catches exceeded 4,000 pounds per 1-hour tow. Also catches from off-bottom concentrations of hake up to 12,600 pounds per 1-hour tow were made on moderate sign. A slight gilling problem in the net's after body occurred when fishing hake. In one tow, 1,000 pounds of white bait smelt, Allosmerus elongatus, averaging 9 cm. in length were taken. This suggested that the net effectively samples small fish populations.

Distribution of Midwater Biomass

Two series of Universal trawl and Isaac-Kidd trawls were made at various levels to ascertain vertical distribution of midwater biomass in relation to sound-scattering layers.

The first series was made over a bottom depth of 40 fathoms off the mouth of the Columbia River at 46°11' N. latitude and 124°13' W. longitude. Three sound-scattering layers were found. The upper two were diffuse, while the layer just above bottom was more distinct and typical of "sign" usually ascribed to hake.

Nothing of consequence was caught at any depth not showing a scattering layer.

Drone Simulation

The auxiliary research vessel Sea Probe cooperating with Commando simulated a drone vessel for fish scouting. Sea Probe scouted for and reported location of schools to Commando, increasing search effectiveness. The former also determined areas of highest abundance in front of Commando during actual fishing. This information was useful in directing Commando during the operations. Visual reconnaissance of Sea Probe's position was not possible beyond 3 miles, and radar was ineffective due to interference from sea return.

Technological Studies

Technologists checked incidence of a myxosporidian parasite in hake from 10 lots

samples. Initial observation of high overall parasitization of stocks, with hake from in-shore hauls having a somewhat higher incidence, continued as in previous years.

Technologists also tested the enzymatic softening of hake at various storage temperatures--and the effect of blood upon oxidative rancidity of rockfish fillets during storage. Two hundred pounds of fillets of various species and 300 pounds of whole hake were collected for studies to determine possibility of making "surimi" (minced fish flesh) and "kamaboko" (fish paste).

Biological Studies

Groundfish Program personnel sampled and processed 1,500 hake at sea for length, sex, and age. Twelve hundred more hake were returned to the Seattle Lab to be processed for length, sex and age--and for physiological work on livers, hearts, and eye fluids. This research is part of a program to monitor the condition of hake stocks off the Pacific coast.

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



'Gilbert' Finds Threadfin Shad & Nehu About Equal Tuna Bait

BCF's Charles H. Gilbert cruised Hawaiian waters to test threadfin shad as a live bait in the pole-and-line fishery for skipjack tuna. The nehu is the bait used in this fishery. (Cruise 109, 5/16-8/3.)

Experimental pole-and-line fishing was conducted with 12 skipjack tuna schools using threadfin shad as bait--and with 10 skipjack tuna schools using nehu as bait. Pole-and-line fishing was conducted with one other skipjack tuna school using both threadfin shad and nehu.

The experimental fishing results are summarized in table.

The researchers report: "There is no significant statistical difference between the catch per unit of effort (mean number of tuna per minute) ($p > 0.4$) between threadfin shad and nehu."

Experimental Fishing Results, Charles H. Gilbert, Cruise 109

Bait	No. of Schools	No. of Tuna Caught	Wt. of Tuna Caught	Size of Tuna Caught (Avg. Wt.)	Avg. No. of Tuna/Min. ^{1/}	Avg. Lbs. Tuna/Min.	Avg. Lbs. Tuna/Lb. Bait	Avg. No. Passes/School	Avg. No. of Bait Buckets/School
Shad	12	1,286	6,726	5.2	8.1	42.1	21.5	3.1	3.7
Nehu	10	1,250	9,236	7.4	9.8	72.5	28.3	3.1	4.6
Total	22	2,536	15,962	-	-	-	-	-	-

^{1/}Four men fishing almost constantly.

The 2 Baits

In general, threadfin shad swim downward at angles estimated to be 45° to 60° after being chummed into the water. Nehu tend to dive down at somewhat steeper angles, estimated at 60° to 80°. Threadfin shad do not appear to dodge as vigorously as nehu--but appear to be much more visible than nehu from the Gilbert's stern underwater chamber. All sizes of threadfin shad (1½"-2½") appear to exhibit the same swimming behavior.

The Gilbert researchers also tested various "transporting, handling, and acclimatizing techniques" to obtain better survival and use of bait. They also collected specimens for themselves and for other scientists in the U. S. and Great Britain.



'Cromwell' Studies Ultrasonic Tags in Sonar Tracking of Tunas

One mission of BCF Honolulu's vessel Townsend Cromwell in a recent cruise in Hawaiian waters was to determine the feasibility of using ultrasonic tags to improve the tracking of tunas with the CTFM sonar. (Cruise 37, 6/5-7/31.)

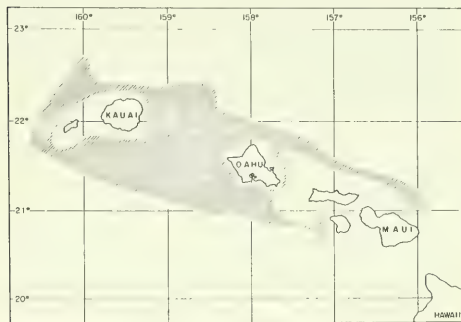
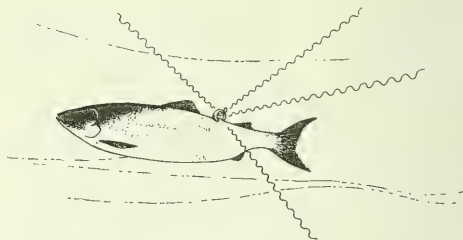


Fig. 1 - Area of sonar operations.

The scientists used cylindrical tags 3 inches long and 1⅛ inches in diameter. The tags transmitted pulses at a rate of 1 per second that were readily detectable 1 mile away. Because the vessel did not have facilities for holding skipjack tuna, 3 little tunny held in captivity for 15 months were tagged and released at sea on separate occasions.

The Operation

Each tag was attached to the fish in the same manner. It was tied securely to the shank of a fish hook. The hook was inserted across the midline immediately posterior to the second dorsal fin. The tunny first was released in a school of skipjack, the second with no fish in sight, and the third in a school of yellowfin. Tracking durations were 77, 117, and 21 min., respectively. On the last two occasions, tracking ended when the tags sank out of range. Neither of the 2 fish released in schools appeared to have joined the schools. All 3 swam off at about 2 knots.



Tag Burdens Small Fish

Later, one of 4 little tunny in a pool at the Honolulu Laboratory's Kewalo Basin was tagged and observed. It was soon obvious that the tag was a burden to the 4-pound fish, which was the size of the others tagged. The tag carrier beat its tail continuously, in contrast to the untagged fish. It always swam closer to the bottom than the other, and it did not school with them except for short, intermittent, periods. After 117 min., the tag slipped off the fish.

Sharks Tagged

Two gray reef sharks (*Carcharhinus menisorrhah*) were caught off Niihau, taken out to sea, tagged, and released. Only brief contact was made with the first shark. Failure to track this shark resulted from a combination of 2 factors: the tag did not start transmitting immediately, and the sea was very choppy.

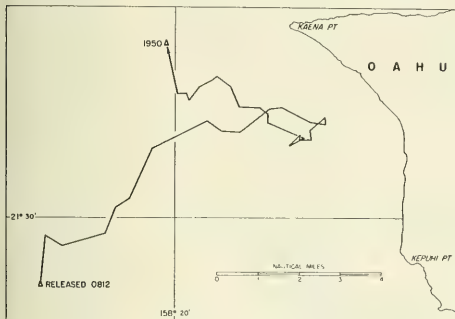


Fig. 2 - Path of tagged shark.

The other shark had a tag introduced into its gut before it was released off leeward Oahu. The shark moved about $17\frac{1}{2}$ miles in the first 12 hours (fig. 2). Then, at sundown, it moved toward the bottom, which was 500 m. deep. When it remained stationary throughout the night and past sunrise, the researchers assumed the shark had ejected the tag. Tracking was discontinued.

Following Tagged Fish Practical

The researchers concluded from the ultrasonic tagging experiences that: (1) following a tagged fish with a ship is practical; (2) tag dimensions must be reduced if fish the size of skipjack tuna are to be tagged; (3) a tag placed inside the fish works as well as one placed externally.



'Oregon' Conducts Midwater Schoolfish Survey Off East Coast

BCF's Oregon completed the fourth in a series of 6 bimonthly midwater schoolfish survey cruises. (Cruise 131, 7/16-26.)

The series is designed to obtain information on seasonal distribution and schooling

density of pelagic schoolfish in coastal waters (5-20 fms.) between Cape Hatteras, N. C., and Jupiter Inlet, Florida. The information will be used to establish criteria for exploratory and experimental fishery operations along the southeast coast. (See chart p. 36.)

High-resolution vertical echo tracings were obtained on 26 standard transects. Continuous surface temperature data and vertical temperature profiles were obtained on all transects.

Findings of Fourth Cruise

Preliminary examination of echo tracings indicated that midwater fish were more prevalent in school size and number than on previous cruises. Heaviest fish concentrations off Florida were located east of Mayport and St. Augustine and off Cape Kennedy. Off Georgia, concentrations were recorded east of St. Simons and Sapelo Islands and east of Savannah. Off the Carolinas, extensive concentrations were located south of Cape Romain in South Carolina, and south and southeast of Cape Fear in North Carolina.



'Oregon' Explores Florida's Scallop Grounds

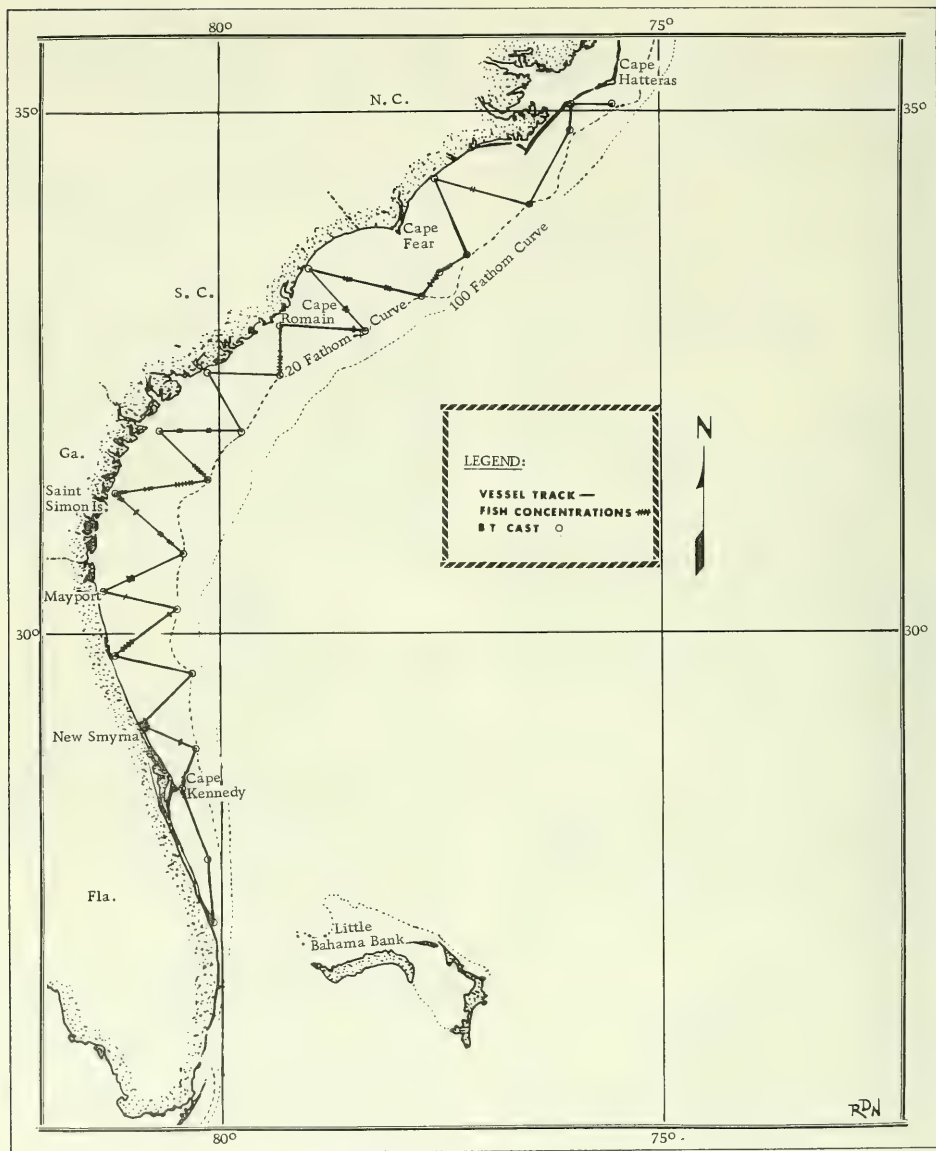
BCF's exploratory fishing vessel Oregon returned to St. Simons Island, Georgia, on August 30 after 10 days of scallop explorations off Florida's east coast. (Cruise 132, 8/21-30/68.) This was the eighth in a series of industrial development cruises to keep an up-to-date check on Cape Kennedy calico scallop (*Pecten gibbus*) grounds.

Principal Objectives

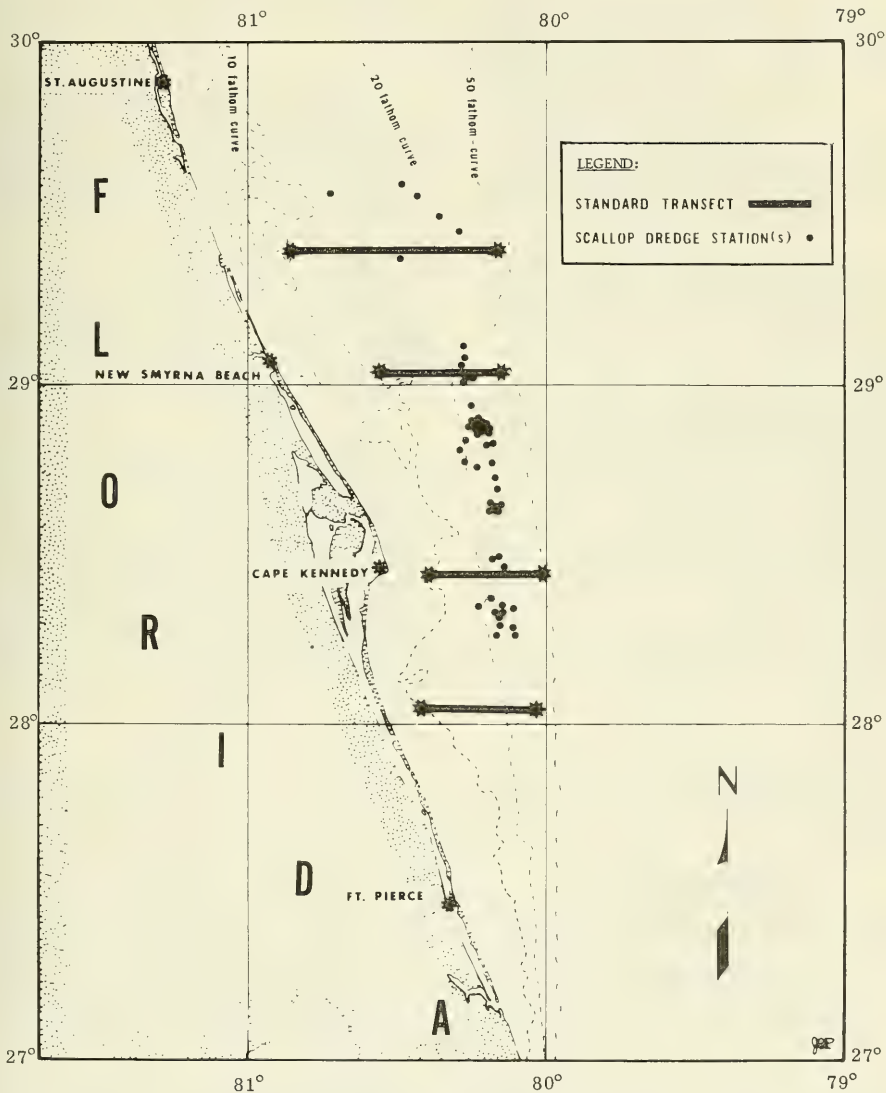
Principal objectives of the cruise were to complete a 12-month assessment of the area, locate the best areas for commercial exploitation in the time available, and provide dredging demonstrations for industry observers. Four standard assessment transects were run in areas established in September 1967 and occupied during each cruise in the series. (See chart p. 37.)

104 Dredging Stations

A total of 104 dredging stations were occupied with 8-foot tumbler dredges fitted with



R/V Oregon, Cruise 131, July 15-26, 1968.



R/V Oregon Cruise 132, August 21-30, 1968.

2-inch bag rings, 20 rings deep. The stations ranged from east of Ormond Beach to north-east of Bethel Shoal. Commercial concentrations were located in 22 to 26 fathoms and in 3 general areas: east of New Smyrna Beach, east of Cape Kennedy, and northeast of Bethel Shoal. Maximum catches ranged from 8 to 19 bushels per 30-minute drag. Meat counts were lower and meat yields were larger than in June. The area from east of New Smyrna Beach to Cape Kennedy continued to be the best for commercial fishing, and 2 vessels were observed dredging in the vicinity.

Northeast of Bethel Shoal, the maximum catch was 12 bushels of scallops per 30-minute drag. The count was 80 meats per pound, and yield was 3.5 pounds of meats per bushel.

East of Kennedy

East of Cape Kennedy, maximum catches ranged from 6 to 19 bushels per 30-minute drag. Counts ranged from 50 to 68 meats per pound, and yielded 3.5 to 5 pounds of meats per bushel.

East of New Smyrna Beach, maximum catches ranged from 6.6 to 11.8 bushels per 30-minute drag. Counts ranged from 55 to 75 meats per pound, and yielded 2.7 to 5.5 pounds of meats per bushel.

Seed scallops and subcommercial-size scallops were found throughout the area surveyed, particularly in the 16- to 24-fathom depth range.

A 1-day dredging demonstration was provided for 6 industry observers. A part of the cruise was conducted in cooperation with BCF biologists investigating the biology of the calico scallop.



'Miss Behavior' Collects Anchovy Eggs

The R/V *Miss Behavior* cruised between San Pedro and Catalina Island, Calif., August 6-8, collecting anchovy or sardine eggs for research use.

The eggs would be used for: (1) feeding behavior experiments; (2) electron microscope studies of developing chloride cells within the epidermis of anchovy and sardine;

(3) experiments considering container sizes of possible value for sardine and anchovy rearing.

Methods

Net tows, using a fine mesh net for anchovy eggs, were made every 5-10 miles along a transect extending 35 miles southward from San Pedro. Eggs were left in collection bottles, capped, and placed in boxes containing bottled ice to reduce rate of embryonic development.

Results

High concentrations of eggs were found along the last 10 miles of the transect just south of Catalina Island. The area was marked by a drop in temperature to 20.5° C. from surrounding water, which ranged from 21.3° C. to 22.0° C.

More than 7,000 viable eggs were brought back to San Diego.

A Second Cruise

Later in August, *Miss Behavior* cruised around Catalina and between San Pedro and Catalina. Her objectives were to obtain anchovy eggs for feeding and electron microscope studies, and to obtain freshly seined adult anchovies from San Pedro Harbor for stomach-content analysis and respiration studies at the laboratory.

Procedures and Methods

The first and second days were spent locating dense patches of anchovy eggs with a fine mesh net. Tows were made within a 20 square mile area just south of Catalina Island.

Adult anchovies were collected from a set just being completed by a commercial boat in San Pedro Harbor. Ten scoops (about 1,500 fish) were placed into a removable bait well in the stern; fresh sea water was pumped through it. Fish that jumped out of the net during transfer were immediately dissected and stomach contents examined under a light microscope.

From San Pedro, the ship returned to south of Catalina where the densest patches of anchovy eggs had been found. Fifteen tows were made and collected eggs were transferred to

polyethylene buckets. All eggs were collected between 0200 and 0430 on August 22. The ship then returned to port immediately.

Results

1. The densest patches of anchovy eggs were found 8 miles south of Catalina. About 20,000 eggs were collected on the morning of August 22. Most eggs were newly spawned and still in early development when brought back to the lab. Preliminary results indicate very successful survival of these larvae.

2. All adult anchovies brought back to the fishery were dead the following day. This procedure is not recommended until major alterations are made to the bait well. Serious clogging of the drain by dead anchovies caused overflow of water into the boat. It necessitated frequent clearing of the drain and decreased water flow.

3. Stomach contents from adult anchovies showed a composition of about 90% unicellular algae and about 10% crustaceans. Algal genera included Platymonas sp., Phaeocystis, Gonyaulax, Coscinodiscus, Rhizolenia, and many small (less than 5 microns) unicellular green algae. Digestion of green algae was fairly complete in the last one-third of the intestine, although both diatoms and dinoflagellates seemed unaffected. Gonyaulax was found still alive in this last portion of the intestine. Zooplankton included various medusae and copepods. Average adult fish length was about 82 mm.



New Shrimp Trawl Sorts Out Unwanted Fish and Debris

A shrimp trawl designed by BCF's Seattle Base produced excellent results during recent tests off Newport, Oregon, in separating fish and debris from shrimp catches.

Several 30-minute tows produced catches averaging about 700 pounds of nearly pure shrimp; less than 3% of the catches was bottom trash and unwanted fish.

How Trawl Works

Most small flatfishes, larger bottom species, smelt, and urchins are screened out by the net and returned unharmed to the ocean.

A unique feature of the trawl is that it consists entirely of wings, codend, trash chute, and chafing gear. It has neither the top nor bottom panels of conventional shrimp trawls. Because only minute amounts of webbing are used, construction costs should be about 50% of standard commercial shrimp nets. Practically no labor is needed to sort catch and very few small fish are killed. Preliminary indications are that catch rates should equal or exceed those of present commercial gear.

Plans are ready to demonstrate the gear to commercial fishermen.



WHAT MAKES THE OCEAN SALTY?

For many years it was assumed that the ocean began as fresh water and that the age of the earth could be determined by comparing the annual increase of salt from rivers with the total salt in the ocean. However, radioactive dating of rocks indicates that the earth is much older than the age derived by such method.

It is now generally believed that the primeval seas were initially salty, having dissolved their salts from the rocks underlying their basins. Breaking up of continental rocks by frost and erosion has added to the salts of the sea, but the dissolved material in rivers contains higher percentages of carbonates than does sea water, where chlorides predominate.

The saltiness of the oceans is undoubtedly increasing, but it is a slow process which has been going on for hundreds of millions of years. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

ARTICLES

"NO CONTEST" ON THE FISHING GROUNDS

By Commander Adrian L. Lonsdale,
U. S. Coast Guard

The Soviet Union has won the battle of the fishing grounds. Their boats are presently reaping rich harvests close to U. S. shores. Using task force operations and the latest fishing techniques, they are exploiting to the limit traditional American fisheries.

In ten years the Soviets have passed the United States in fish production and now occupy fourth place, exceeded only by Japan, Peru, and Communist China. In fishing fleet strength, the Soviets rank third behind Japan and Norway. Until the late 1950s, the United States ranked second only to Japan in size of catch. Now the United States is in fifth place and is in danger of being relegated to sixth by Norway.

Russia increased her fish production from 2.5 million metric tons in 1954 to more than 6 million tons in 1966. This is about 9.5 per cent of the world's catch. Soviet goals call for a yearly production of 8.5 million tons by 1970. It is conceivable that they could lead the world in fish production within the next decade.

Meanwhile, U. S. fish production remains static--about 3 million metric tons annually, or about 5 per cent of the world catch.

Under their present five-year program (1966-1970), the Soviets will invest about \$650 million per year in their fishing industry and fleets. This rate is two-thirds more than they spent in the previous five years (1960-1965). They will add 1,500 vessels to their fleets, presently estimated at more than 18,000 motor vessels. New acquisitions will include 250 large stern trawlers from Polish and East German shipyards, and 145 refrigerated fish carriers, factory ships, and floating factories from West Germany, Japan, and Holland.

Before 1948, the Soviet fishing industry was crude and confined to inland and coastal waters. The over-fished areas could not possibly support the need for protein at home.

Soviet agriculture fell far short of goals. Economic studies showed that fishery products could be produced with 25 to 30 per cent less capital investment than the same quantity of meat products. To produce one ton of cattle costs more than twice as much as one ton of fish. Further incentives for expansion of offshore fisheries were the existence of Baltic ports and skilled fishermen which had been brought into the Soviet sphere as part of newly acquired Satellite countries.

Today, 90 per cent of Soviet deep sea fishing takes place too far from home for fresh fish operations. With few overseas bases, they were forced into developing methods for processing the catches at the fishing grounds. This has resulted in a steady increase in the size and capability of Soviet trawlers and the development of auxiliary ships capable of supporting a large fleet thousands of miles from home for months at a time.

Soviet fishing operations need not be justified on an economic basis. Their objective is volume, but they try to get the fish to the consumer as cheaply as possible. Fish are generally delivered to the retailer in the container in which they were packed at sea. Bulk salted fish may be delivered in 200-pound barrels and frozen fish in 66-pound cartons. The consumer pays about 25 cents per pound for it.

Prices are established by a central price bureau after consultation with fishery experts. Labor, operating, maintenance, and a mortization costs are used. If they are covered by the price received, the voyage is considered profitable. When a voyage is unprofitable, subsidies are paid by the state. This ensures an adequate protein supply for Soviet citizens.

Soviet fish production is controlled by the State Committee of Commercial Fisheries Production. Under the State Committee is the Main Fisheries Administration. It controls fleets at sea through five regional

subdivisions headquartered as follows: Western in Riga, Northern in Murmansk, Black Sea in Sevastopol, Caspian in Astrakhan, and Far East in Vladivostok.

A fishing fleet may consist of as many as 100 trawlers controlled by a base chief on board one of two base ships. He receives information twice daily from the trawlers concerning the number of trawls made and amount of fish caught by species. After correlating this data with that received from trawlers on scouting missions, he may direct vessels to more lucrative grounds. The information is also used to schedule the offloading of catches to transports.

The Soviets are constantly adding more sophisticated ships to their fleets and updating their fishing procedures. Vessels operating on our side of the ocean are new, having been built in the late 1950s and later.

Side-trawlers range in size from 125 feet to about 200 feet long. Smaller ones stow fish in a 30 per cent salt solution in barrels. When the catches are delivered to one of the base ships, the fish are sorted and repacked in a 15 per cent salt solution in barrels and stowed at a temperature of 18 degrees F. Many of the larger side-trawlers can process and refrigerate part of their catches prior to delivery.

Fish-factory-trawlers range in size from 250 to 300 feet long. The largest ones have a cargo capacity of approximately 1,400 tons. They carry crews of from 96 to 102, usually including about six women. Trawls are operated from a ramp in the stern. The ships are more efficient than side-trawlers in retrieving their catches and can make large hauls of more than 15 tons per set. Daily quotas range from 25 to 50 tons depending on the size of the vessel and the type of fish being caught. They process their own fish and deliver it to a transport with no further handling required. In addition to processing frozen and salted fish, they may also manufacture fish meal and oil. They are equipped with filleting machines for processing haddock, cod, and ocean perch.

Fish transports are refrigerated passenger-freighters about 500 feet long. They act as base ships when with the fleet. Their turn-around time is about 25 days, depending on how long it takes to be loaded. They are comfortable ships with pleasant accommodations and are manned by a crew of about 200, including 40 women. They have doctors, well-equipped medical and dental facilities, two 12-bed hospital wards, and an outpatient clinic.

Ocean-going tugs about 200 feet long usually accompany the fleets. They are equipped



The "Konstantin Sukhanov," a passenger-freighter, was converted to a fish factory ship for crab fishing in the Bering Sea.

to handle emergencies at sea such as towing, salvage, and repairs. Their doctors (usually women) render medical assistance.

Passenger ships and tankers may also be found from time to time bringing replacement crews and fuel.

A fishing vessel may be operated continuously for six months or more before being sent home for repairs and maintenance. The crews are rotated every three to four months. While at sea, they eat four meals a day, and entertainment includes motion pictures which are shown twice daily in the larger ships.

With most logistic operations taking place at sea, the Soviets have developed to a high degree the art of bringing ships alongside each other while one is at anchor. With clusters of very large pneumatic fenders, Soviet fishermen can conduct transfer operations in a gale-force wind.

Navigation is done with sextant, Fathometer, radio direction finder, and by dead reckoning. Larger vessels are equipped with Loran receivers. Smaller boats, when close enough to land, use radio direction finding on shore stations as a primary means of navigation. When too far from shore, DF bearings are taken on the base ships which anchor about 30 miles apart. The base ships fix their positions using Loran and celestial observations.

The base pay of a member of the fleet is the same as for an equivalent job of equal responsibility in the homeland. To compensate for the long periods away from home, he is entitled to a 150 per cent bonus for sea pay. Only 80 per cent of the bonus is guaranteed and the remaining 20 per cent depends on whether the fishing vessel catches her quota. The value of fish in excess of the annual quota is divided into shares, of which the captain gets two, other officers something less, and the crew gets one share each. On the average, Soviet fishermen earn about 300 rubles (\$333) per month.

Leave is accrued at the rate of 42 days per year for the captain and 36 days for a crew member per year, with pay. The rate of pay for leave is based on the average of the individual's pay and bonuses for the previous year. Each Sunday at sea counts for one more day of leave with pay. While on board ship, the fishermen are entitled to free food and medical services.

The Soviets are presently conducting their fisheries research on a world-wide basis. Their fleets are fishing in most of the major oceans of the world. Over the years their operations have progressed steadily southward.

In 1966, the Soviet Union established a fishing fleet command in Havana, Cuba. The base there includes ship repair yards, cold storage plants, canneries, and warehouses. Extensive docking facilities can service more than 100 Soviet and Cuban ships.

This new stepping-stone in the Caribbean facilitates exploitation of untapped marine resources in the Western Atlantic, particularly off the coasts of Central and South America. Under-fished species there are being harvested by the Soviets and by Cubans who are assisted by Soviet technicians. South American countries, whose only concern for their fishing grounds used to be the appearance of an occasional U. S. shrimper or tuna boat or a fleet of Japanese tuna boats, have had their complacency shattered as Soviet, Cuban, Yugoslav, and East German trawlers have moved into traditional fishing grounds.

The Northwest Atlantic fishing interests of the United States and Canada suffered the same trauma when, in 1961, a small number of medium-class Soviet trawlers began exploratory fishing on Georges Bank off New England. In 1962 and 1963, Soviet vessels there increased to 300-400 during peak summer months. During 1964 and 1965, the number declined to between 150 and 180 vessels during the peak season, but their catches continued to increase from 68,000 tons in 1961 to 300,000 tons in 1965. The size of the catch, then, is not proportional to the number of Soviet vessels fishing in the Northwest Atlantic. There has been a rapid increase in fish production due to advanced design and increased capacity of later model trawlers. Also, fisheries research has provided valuable data for improving equipment and techniques, and determining fish behavior and oceanography, thus allowing timely adjustments according to fish distribution and environmental changes.

Although the Northwest Atlantic region equals less than one per cent of the world's ocean area, it produces 11 per cent of the world's fish directly consumed by humans. Almost all of the catch is prime, high-grade fish in great demand as human food. Very little is reduced to meal and oil or other by-products. In the area, total landings by all

countries have increased from 1.8 million metric tons in 1955 to more than 3 million in 1966. However, U. S. fishermen have not shared in the increase; in fact, their tonnage has dropped during the past ten years from 550,000 metric tons to 326,000.

Alaskans have been upset since 1959 when the Soviet Union began operating large fishing fleets in the Bering Sea and in the Gulf of Alaska. In peak periods they have had 400 vessels in those waters catching herring, perch, flounder, sole, cod, pollock, king crab, shrimp, halibut, and whales. Fifty research ships and 300 Soviet scientists have probed the Pacific as far south as New Zealand and Australia. Fisheries research has been concentrated in the Japan, Okhotsk, and Bering Seas; the North Pacific Ocean off Canadian, U. S., and Mexican shores; the New Zealand Plateau and the Great Australian Bight; and the Indian Ocean. They have also conducted studies of the resources southeast of Latin America.

As a result of their discoveries, the Soviet Far Eastern fishing fleet expanded operations into the waters off British Columbia, Oregon, Washington, Baja California, and into the South Pacific and Indian Oceans. Off the Pacific Northwest Coast in 1966, they landed over 130,000 metric tons of an untouched Pacific hake resource.

As the Soviets move into new areas, their scientists must work hard to develop techniques for handling new species of fish they expect to catch. One Soviet innovation uses sounds of predators to force fish to the bottom where they are easily caught by a bottom trawl. Soviet scientists claim that by forcing the fish down, they can increase the effectiveness of their fishing gear between 300 and 500 per cent. This is only a short step from herding fish into a net, trap, or fish pump.

In fact, by using cages, lights, and electric current, the Soviets in the Caspian Sea are herding fish into cages where they are pumped onto a vessel. They say the cost of the fish pump operation is about one-third that of a net operation.

The Soviets have developed a series of techniques for improving trawl catches. The simplest is to hit the fish with an electric charge as they enter the mouth of the trawl. The fish are also prevented from escaping by a series of clever optical illusions woven into the net.

The Soviets claim that by using acoustical signatures, they can distinguish types of fish. For instance, they say they can distinguish between types of tuna by the sounds of their fins and tails as they move through the water.

Before 1950, Soviet fishing methods were considered crude when compared to ours. Now the situation is reversed, and present Soviet successes are only a prelude to greater activity close to our shores. Not only will Soviet activity increase, but the growing fishing industries of other nations, such as Poland, East and West Germany, Romania, Canada, Japan, and Cuba, will concentrate more and more of their efforts on North American fisheries resources.

Marine resources, fortunately, are renewable. But they are not inexhaustible. With any species there is a maximum level that can be harvested on a sustained basis. Fortunately, in some areas, the fishing nations are working together to prevent the depletion of fishery resources. They are concerned and in most cases honor conservation treaties. Many agreements are in effect in both the Atlantic and Pacific Oceans. Trade-offs are often required, as in recent agreement whereby the Soviets will limit their catch off the mid-Atlantic states. In return they obtained concessions enabling them to conduct at-sea transfer operations in sheltered loading zones off Long Island and New Jersey.

The consumption of fish products in the United States has increased from 7 billion pounds in 1955 to about 13 billion in 1966. This rate is expected to double in the next 20 years. The potential yield from waters adjacent to the United States is estimated at about 22 billion pounds annually, but the U. S. catch seems to be stagnated at about 5 billion pounds per year. The rest is imported.

Compared with the industrially organized Soviet fishing industry, our fishing activities are fragmented, and most are managed by small independent operators. There are about 130,000 U. S. fishermen operating 65,000 boats of less than five tons and 12,000 larger vessels. They supply fish for about 4,000 establishments employing about 57,000 workers.

The promotion of a vigorous fishing industry in this country requires public awareness of the country's needs and the desire to maintain a place among the leading fishing nations of the world. Presently the Bureau of Commercial Fisheries spends only \$28 million

annually on research. The National Academy of Sciences predicts that rational development of U. S. domestic fisheries could double our production in 15 years and the growth of U. S. overseas fisheries could be quadrupled by 1980. Scientists say that fisheries-oriented

science could add \$2 billion a year to the gross national product within ten years.

The U. S. fishing industry needs resuscitation. Only a radical change in the public attitude can revive it--something akin to our urge to get to the moon first is required.



Progress of Fishing Industry and Soviet World Role Outlined

Shortly after the opening of the International Exhibition, "Inrybprom-68," in Leningrad on August 6, Nikolai Uporov, Deputy Minister of Fishing of the USSR, released this statement on the progress of the Soviet fishing industry--and on Soviet cooperation with other nations in fishing matters:

"Last year the Soviet Union caught 6,500,000 tons of fish and marine animals. The Soviet Union occupies third place in the world for fish and marine animal catches, and is on the list of the five biggest fishing countries in the world. The rate of increase in the amount caught can be seen from the fact that the catch in the first six months of this year was approximately equal to the total taken in the whole of 1961.

"The Soviet fishing industry has a powerful modern fleet with an unlimited range of operation. It holds second place in the world as regards the number and power of the ships. The fleet has nearly 20,000 powered boats, including vessels for catching, processing, transporting and refrigerating. It has ships for research work and prospecting, and life-boats and other auxiliaries. The USSR has the biggest flotilla in the world of large-size refrigerator trawlers. These are unique

floating factories. They deliver finished products to the ports and this increases the profitability of the operation considerably. Three or four trawlers of this type can meet, in one expedition, the demand for fish of a town with a population of a million.

"The modern Soviet fishing ships are equipped with radio-electronic instruments, which enable the boats to keep strictly to the desired route, detect shoals of fish, and maintain ship-to-ship and ship-to-shore contact. The search equipment developed with the use of echo-sounders is widely used to detect deep-sea and surface fish, whales and crabs, and to control the operation of trawl nets. Our fishing fleet has Soviet-made apparatus for horizontal and vertical prospecting, which gives the accurate position and density of fish shoals. Thanks to this, we achieved and mastered, for the first time in world practice, varied depth target trawling. This was done in 1956.

"The manpower of our fishing industry includes 60,000 specialists with higher and secondary technical education, navigators, mechanics, electricians, specialists in fish catching and processing, and whalers. The Fishing Ministry runs five higher schools and 24 secondary schools.

"The Soviet Union conducts active fishing and the catching of other marine animals in different parts of the world oceans. In this connection the Soviet Union is cooperating on an international level with other countries. It is a party to 30 intergovernmental agreements on fishing. Our country is cooperating closely and extensively with European socialist countries which have well-developed modern ocean-faring fishing fleets. The cooperation covers practically all the main fields of theory and practice relating to the fish industry, such as estimation of the reserves of commercial fish, the technology of catching and of the fishing fleet itself, of fish processing, and so on. Specialists from socialist countries jointly compile annual fishing forecasts, and these are used mainly for the siting of fishing fleets in the areas of operation. Reciprocal visits are made by specialists to exchange experience. An intergovernmental agreement on cooperation in the development of marine fishing has been concluded between the USSR and Cuba.

"The USSR is giving technical assistance to a number of developing countries, among them the United Arab Republic, the Republic of Guinea, the Republic of Senegal, and the Somali Republic. Soviet specialists share their experience in developing oceanic fishing, in increasing the productivity of internal reservoirs, and in the training of native personnel for the fishing industry.

"The USSR and the countries with well-developed fishing industries, such as Japan, Norway, Britain and France, cooperate in the field of fishing on the basis of mutual interest in preserving the fish resources of the world oceans. The Soviet Union strictly observes the obligations assumed under intergovernmental agreements and is fully prepared to further develop cooperation with all the countries interested in the rational utilisation of the resources of the oceans of the world.

"In the light of all this we regard the International Exhibition "Inrybprom-68" as an effective instrument in extending and strengthening this cooperation." ("Moscow News," Aug. 10.)



THE ROLE OF INTERNATIONAL AGREEMENTS IN ALASKAN FISHERIES

By Ronald C. Naab*

Foreign fleets fishing in international waters off Alaska are capable of depleting the resources supporting Alaska's largely inshore fisheries. Recognizing this threat, the United States has increasingly utilized international fisheries agreements, particularly during the last few years, to provide safeguards essential to the U. S. fisheries off Alaska. Policing these agreements by joint Coast Guard-Bureau of Commercial Fisheries patrols has been stepped up to keep pace with the increased enforcement responsibilities and growing foreign fishing efforts. As nations of the world increase their harvests of protein from the seas, international agreements will become more important in protecting U. S. interests in the vast fishery resources of the Alaskan area.

Marine resources supporting Alaska's foremost sustaining industry, commercial fisheries, are highly vulnerable to depletion by fleets operating in international waters adjacent to Alaska's shores. The species traditionally most important to Alaska--salmon, halibut, king crab, and fur seal--spend a major part of their lives in waters of the high seas beyond U. S. jurisdiction. While in these offshore areas, these migratory animals, in the absence of international safeguards, could be intercepted by fishermen of any nation before reaching Alaska's largely inshore fisheries.

The same threat hangs over the underutilized fishery stocks that offer the greatest potential for development by the U. S. fishing industry. These include species already becoming more important to Alaska's fisheries--tanner crab, shrimp, and scallops--as well as stocks likely to be developed in the future: pollock, ocean perch, flounders, and sablefish.

The U. S. has long recognized this danger to Alaskan fisheries and has increasingly sought to provide protection by international agreements. The urgent need for such protective agreements was accelerated greatly by the alarming growth of Japanese and Soviet fisheries off Alaska during the past decade

(figs. 1 and 2). Since 1964, the number of such agreements and associated U. S. laws has nearly trebled, climbing from 4 to 11. Through these agreements, harvesting by foreign fishermen of species essential to the Alaskan fisheries either has been controlled or prohibited. The gravity of this situation is evidenced by 1966 statistics. These show the species protected by such agreements provided 96 percent of the value of Alaska's commercial fisheries manufactured products, which had a total wholesale value of over \$200 million.

DEVELOPMENT OF AGREEMENTS

The pattern of increased protection afforded the U. S. fisheries can be pictured by tracing the development of international agreements and associated laws affecting the Alaskan area.

North Pacific Fur Seal Convention

This was the first, and is perhaps the best known, international fishery convention that followed a serious decline or depletion of fishery resources of concern to several nations. It is a notable example of how nations, faced with a mutual conservation problem, worked together to restore and maintain a resource so that it provided a sustainable annual yield.

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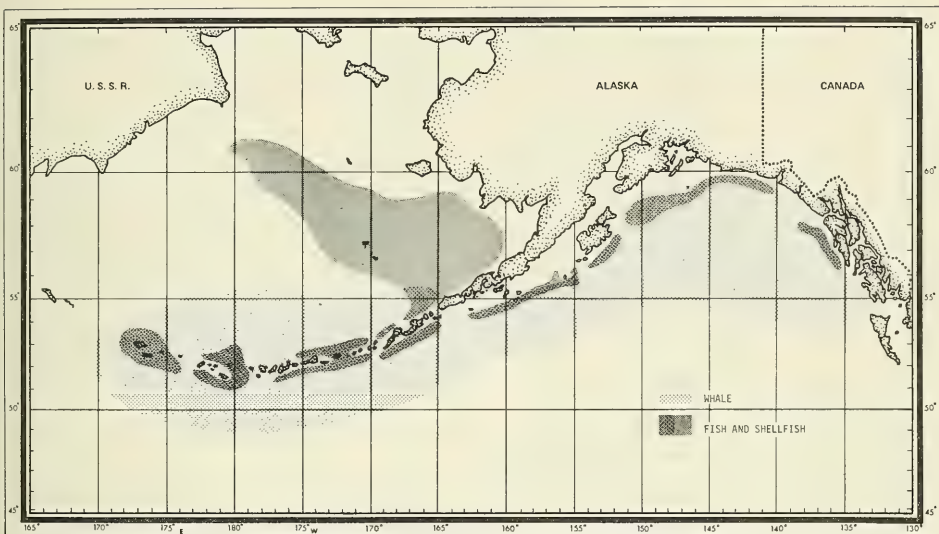


Fig. 1 - Japanese fishing areas off Alaska. (Excluding high seas salmon fishing areas.)

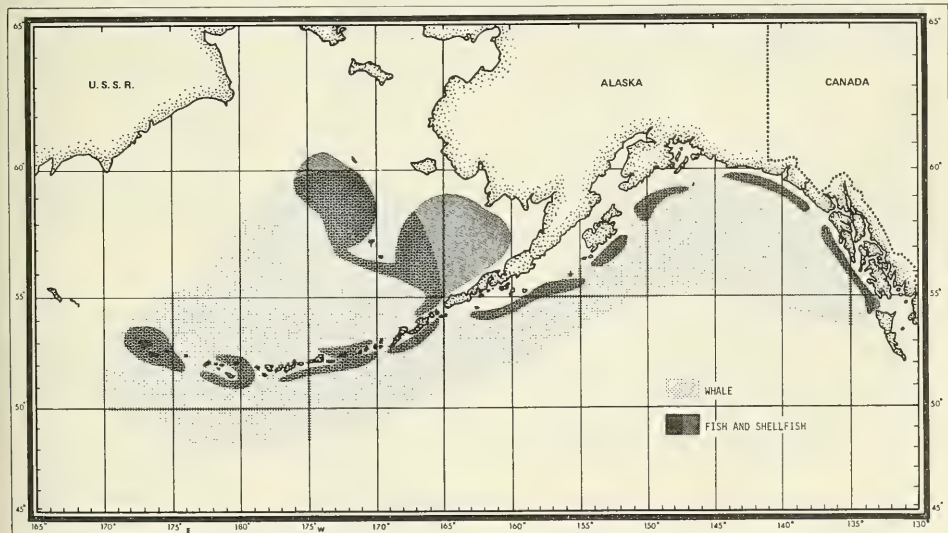


Fig. 2 - Soviet fishing areas off Alaska.

The main North Pacific fur seal herd breeds on the Pribilof Islands in the eastern Bering Sea. These animals migrate over a wide range in the North Pacific Ocean; east along the North American coast to off southern California, and west along the Asian coast to near central Japan. Wholesale slaughtering of the seals both on the breeding islands and the high seas had decimated the herds by the late 1800's. In 1911, following negotiations inspired by concerned conservationists, the original North Pacific Fur Seal Convention was signed by Great Britain (for Canada), Japan, Russia, and the U. S. The original agreement was terminated in 1941. An Interim Convention signed in 1957 is subject to renegotiation in 1969.

This agreement prohibits the taking of fur seals on the high seas and limits their harvesting to government-controlled removals on the breeding islands. Since its inception, the Pribilof fur seal herds have increased from fewer than 150,000 animals to about 1,750,000 in recent years.

During 1960-67, the average yearly harvest from the Pribilofs was 65,800 seals. The U. S. share of the proceeds from these pelts was nearly \$3 million a year. The State of Alaska profits directly from these harvests by receiving 70 percent of U. S. net receipts.

International Pacific Halibut Convention

The eastern North Pacific halibut stocks, like the fur seal herds, declined severely under intensive and unregulated fishing by more than one nation. The halibut fishery of the U. S. and Canada began in 1888. By 1915, the annual catch had soared to a record 69 million pounds. Then catches fell precipitously and remained low until well into the 1930's.

Recognizing the need to preserve this resource, the U. S. and Canada formulated the International Pacific Halibut Convention, which became effective in 1924. Management of the fishery by the two nations has been continuous through later conventions. The present agreement of 1953 will remain in force until either nation gives notice of its desire to terminate it.

Regulations formulated under this agreement establish fishing areas and seasons, catch quotas, legal types of fishing gear, and minimum sizes of fish that can be taken. Under the careful management of the two-nation

commission, the halibut stocks have been restored. The catches have reached a sustained level of over 60 million pounds a year--taken predominantly on the Continental Shelf off Alaska.

In recent years, maintenance of the U. S.-Canada longline halibut fishery has been complicated by growing Japanese and Soviet trawl fisheries. These trawl fisheries take some halibut incidental to their catches of other groundfishes, which amount annually to well over a billion pounds. Although halibut represent only a very small percentage of the Soviet and Japanese trawl catches, the cumulative removals may endanger maintenance of the halibut stocks. The impact of the incidental trawl catches is receiving increasing study by the Halibut Commission.

International Whaling Convention

Whaling as an industry began as early as the 12th Century and has deep roots in early U. S. history. The whale populations of the world's oceans have been depleted progressively--first those of the Northern hemisphere and, more recently, the southern seas. The declines were hastened by development in the mid-1920's of pelagic or high-seas whaling with the harpoon gun and the large mechanized factory ship. By 1930, excessive and unrestricted catches had so reduced the number of whales that it was obvious to all whaling nations that limits were needed to protect the remaining stocks. A conference was held in 1930. An agreement was finally reached and adopted in 1937. Most major whaling nations were signatories to later revisions, which resulted in the 1946 convention now in force. Nations may withdraw from the convention in any year.

The convention provides for setting whaling seasons and areas, limiting numbers and species of whales killed, recommending research programs, and reviewing scientific findings. In general, the convention provides that each Contracting Government exercise broad powers of regulation and enforcement over whaling by its flag vessels. Since U. S. whaling has not been conducted off Alaska for many years, the principal U. S. role in the Alaska area has been surveillance of the large foreign whaling fleets to determine their compliance with the international regulations.

International North Pacific Fisheries Convention

In 1953, the International North Pacific Fisheries Commission (INPFC) was established by a Convention between Japan, Canada, and the U. S. to provide major safeguards to three species vitally important to Alaskan and other North American fishermen. The safeguards were provided through the introduction of a new concept in international fisheries regulation—"abstention." This concept recognizes that the high levels of productivity maintained in some fisheries are the result of long and continuous conservation efforts. In view of these efforts, the Convention provides for abstention from fishing these stocks by some member nations where it can be shown that, historically, these have not fished the stock--and that the other member nations are fully utilizing the resource and have it under study and scientific management.

Under the terms of this Convention, the Japanese currently abstain from fishing for salmon in either the Bering Sea or North Pacific Ocean east of the "abstention line" of long. 175° W. (intersects the central Aleutians), and the Canadians abstain from fishing salmon in the Bering Sea east of the same line. Further, the Japanese also refrain from

fishing for halibut of North American origin in Convention waters off the coasts of Canada and the U. S., exclusive of the Bering Sea (fig. 3). Fishing for herring by the Japanese along parts of the Canadian Pacific coast is also prohibited. The INPFC will continue in force until one year following notice of intent to terminate by a Contracting Party.

This Convention has been criticized and described sometimes as inadequate. But it does protect nearly all the North American salmon stocks, including most major runs in Alaska, as well as the eastern Pacific halibut populations of great importance to the U. S. and Canada.

Prohibition of Foreign Fishing Within Territorial Waters

In May 1964, the U. S. enacted Public Law 88-308, commonly known as the Bartlett Bill. This law makes it unlawful for a foreign fishing vessel, or a master of such vessel, to engage in the fisheries in U. S. territorial waters or to take any Continental Shelf fishery resource that belongs to the U. S., except as provided by the Act or by an international agreement to which the U. S. is party. The Act establishes penalties, provides for seizure and forfeiture of a vessel or its catch or

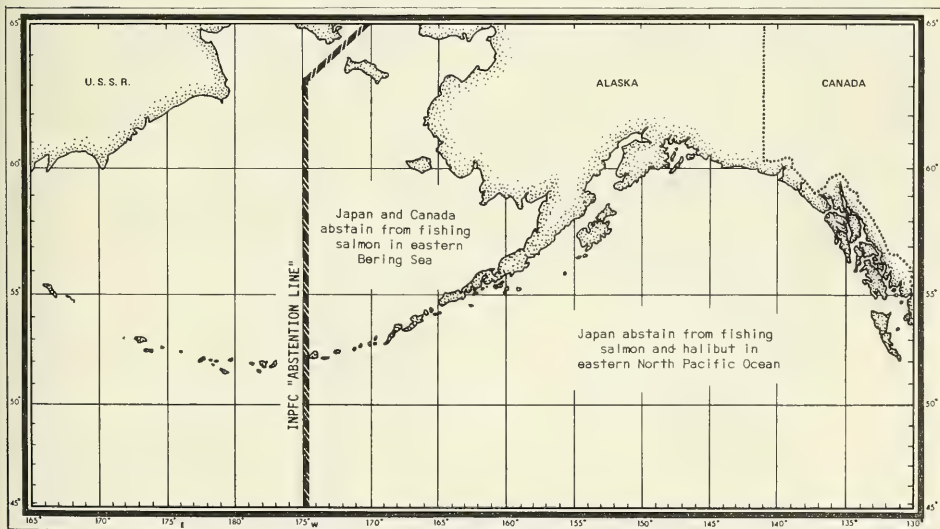


Fig. 3 - "Abstention" areas established by the INPFC.

gear, and delegates enforcement responsibility and enforcement powers. It was enacted following increasing entries by foreign fishing vessels into the territorial waters off Alaska. It had become evident that existing laws were inadequate to make abundantly clear that foreign vessels are denied the privilege of fishing within U. S. territorial waters and, further, that there were no effective sanctions to punish violators.

This Act defines "fisheries" as the "taking, planting, or cultivation of fish, mollusks, crustaceans, or other forms of marine animal or plant life." Enactment of Public Law 90-427 in July 1968 broadened the definition of fisheries to include support operations.

This law provides the legal framework for the U. S. to designate fishery resources of the Continental Shelf and, thereby, to regulate their harvest by foreign nations. The Continental Shelf fishery resource is defined as including "living organisms belonging to sedentary species; that is to say, organisms which, at the harvestable stage either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil." This language conforms to that in the United Nations Convention on the Continental Shelf, which became effective in June 1964.

The designation of a Continental Shelf fishery resource could produce repercussions in other countries. Citing the U. S. action as a precedent, other nations could make claims to species off their shores which might not meet the precise criteria laid down in the United Nations Convention. Nonetheless, the U. S. is proceeding with the preparation of an initial list of living organisms that qualify as Shelf resources. Publication of this list in the "Federal Register," provided by the 1964 Act, will make it illegal for foreign fishing vessels to harvest on the Continental Shelf of the U. S. those species listed.

U. S.-USSR Kodiak King Crab Gear Area Agreement

This agreement became effective in December 1964. It was designed to reduce recurring interference with, and damage to, the U. S. king crab fishery by Soviet trawlers in the Kodiak Island area. The agreement provides for the closure to trawling of six areas off Kodiak Island during periods when concentrations of king crab pots occur there (fig. 4).

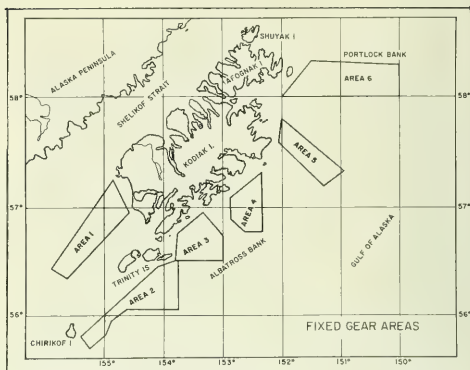


Fig. 4 - Fixed fishing gear areas established by 1964 U.S.-USSR agreement.

These areas were established in accordance with the past pattern of the U. S. king crab fishery off Kodiak Island. The areas extend well beyond the 12-mile fishery limit of the U. S. and have provided a high degree of protection for U. S. fishing gear. Since this agreement became effective, conflicts in the Kodiak area have been greatly reduced. There have been no documented Soviet violations.

The agreement provided that small shrimp trawlers will be permitted to operate in such a way that they do not interfere with fixed gear in the specified areas. This provision allows the increasing number of Kodiak-based U. S. shrimp trawlers to operate within the fixed gear areas throughout the year.

The original agreement was for 3 years and has been extended for 1 year without change. It will be the subject of discussions with the Soviet Union in early 1969.

U. S.-Japan King Crab Agreement

Following the U. S. declaration of intent in Public Law 88-308 to protect resources of the Continental Shelf, this agreement covering the king crab fishery in the eastern Bering Sea was negotiated in November 1964. In the agreement, the U. S. contended that king crab are a resource of the Continental Shelf and subject to U. S. control anywhere on the shelf adjacent to the U. S. Japan, which is not a signatory to the Convention on the Continental Shelf, argued that king crab are a high-seas resource. The agreement was concluded

without prejudice to the positions of both parties, but Japan agreed to certain restrictions on its longstanding crab fishery in the Bering Sea.

Major features of this agreement, which protected the rapidly growing U. S. king crab fishery and safeguarded the king crab resource, included: (1) limiting Japanese catches to an annual quota; (2) providing an area north of Unimak Island where pots only may be used for king crab fishing (other types of gear may be fished for other species in this area); and (3) restricting Japanese fishing gear and methods such as minimum mesh size of tangle nets, use only of pots or tangle nets, minimum size of crabs taken, and retention only of male crab. It also permitted continuation of the longstanding Japanese king crab fishery in the eastern Bering Sea--essentially on the Continental Shelf of outer Bristol Bay.

These provisions allowed the U.S. fishermen to continue expanding their king crab fishery in the Gulf of Alaska and along the Aleutian Islands without competition from Japanese crab fleets; also the agreement enabled the expansion of the U. S. crab fishery

into an area of the eastern Bering Sea without interference by Japanese tangle nets (fig. 5).

The agreement of November 1964 was for a 2-year period and established an annual quota for the Japanese during 1965 and 1966 of 185,000 twenty-four-pound cases. The agreement was extended for 2 years in November 1966 with a provision reducing the annual Japanese catch quotas in 1967 and 1968 to 163,000 twenty-four-pound cases.

U. S.-USSR KING CRAB AGREEMENT

Following the agreement with Japan, a similar one was reached with the Soviets in February 1965. Its provisions were basically identical, with the exception that the Soviets' annual catch quota was less than the Japanese. The exception was based primarily on the Soviets' smaller catches and shorter history of king-crab fishing in the eastern Bering Sea. The Soviets recognized the U. S. position that king crab were a resource of the Continental Shelf over which the coastal state has sovereign rights.

This 2-year agreement protected the growing Alaska king-crab fishery and permitted

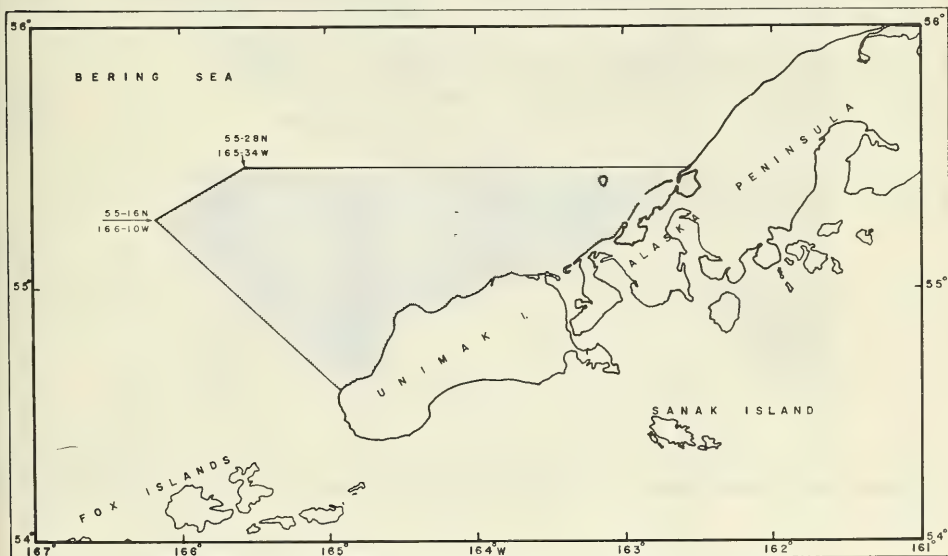


Fig. 5 - Pot fishing zone established by U. S.-Japan and U. S.-USSR king crab agreements.

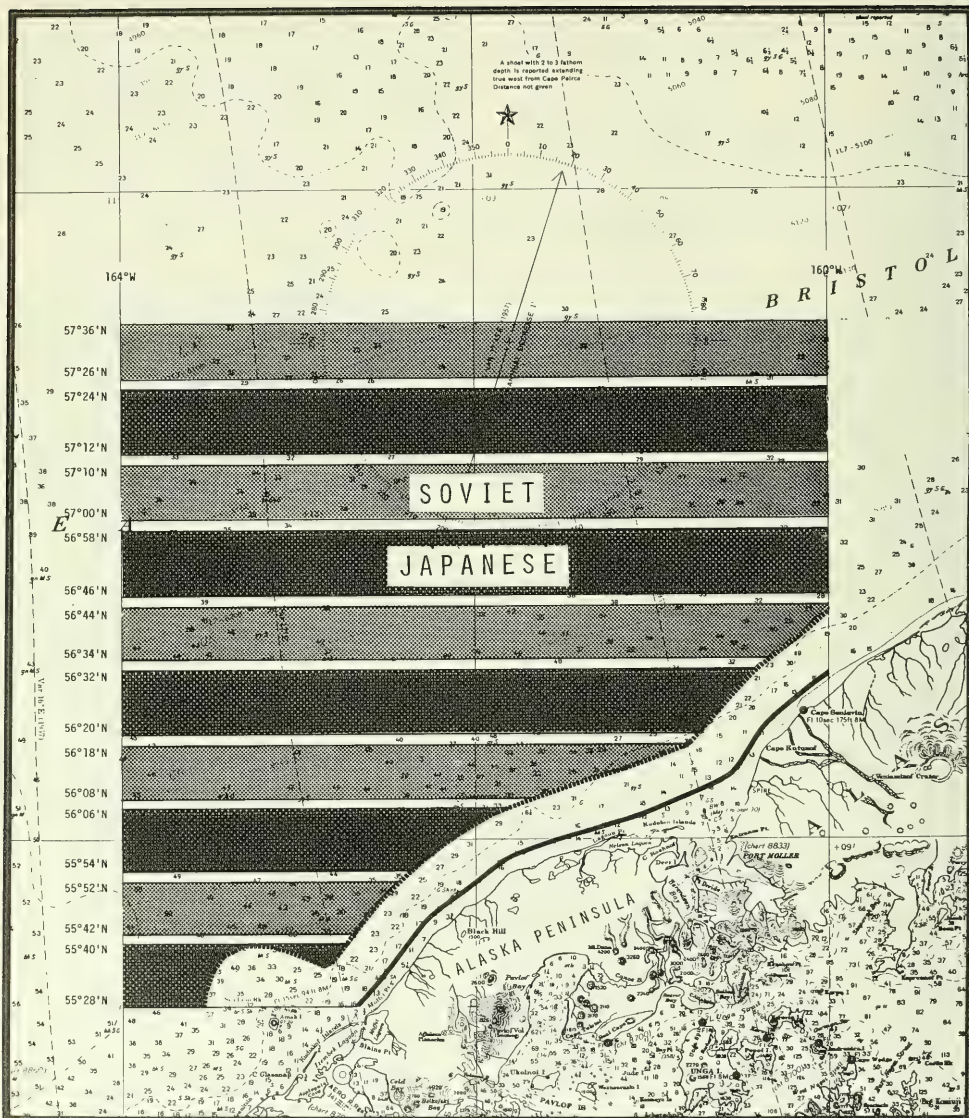


Fig. 6 - 1968 Japanese and Soviet king crab fishing areas established by 1967 Japan-USSR agreement.

the Soviet king-crab fishery off Alaska to continue only in the eastern Bering Sea. The agreement provided that in 1965 and in 1966 the Soviets could take 118,600 twenty-four-pound cases. This agreement was extended for 2 years in February 1967, with the provision that the annual pack in 1967 and 1968 would not exceed 100,000 twenty-four-pound cases.

One innovation resulting from renegotiation of this and the Japan king-crab agreements was the division of the fishing area between the Soviets and Japanese (fig. 6). The agreement between the two established specific fishing zones for each country to prevent gear conflicts. More important for the U. S., the agreement would prevent wasteful fishing methods by the two countries. In the past, Soviet and Japanese fishermen competed for better fishing areas and reserved selected regions by preoccupying them with excessive amounts of gear. Such practices resulted in excessive mortality of king crabs.

Regulation of Foreign Fishing Within the Contiguous Fishery Zone

Public Law 89-658, enacted by Congress in October 1966, established a 9-mile contiguous fishery zone adjacent to the U. S. 3-mile territorial sea. The law provides that the U. S. will have the same jurisdiction over fisheries within this newly created zone as it has within its territorial sea, subject to the continuation of "traditional" fisheries by foreign nations.

Shortly after enactment of the contiguous fishery zone law, the U. S. began negotiations with the foreign nations whose fisheries off Alaska might be considered "traditional."

U. S.-USSR Contiguous Fishery Zone Agreement

This agreement was the first resulting from the negotiations and was concluded in February 1967. The Soviets were permitted to fish within the 9-mile (3 to 12 miles offshore) contiguous fishery zone in three areas off the Alaskan coast little used by U. S. fishermen. The areas include one in the Gulf of Alaska, a second along the eastern Aleutian Islands, and a third encompassing the far western Aleutians (fig. 7). The Soviets were also permitted to conduct loading and fishing vessel support operations within the contiguous fishery zone in three small areas in the

Gulf of Alaska: (1) off Forrester Island, (2) off Kayak Island, and (3) off Sanak Island.

To reduce interference with U. S. halibut fishermen by Soviet trawlers, the Soviets agreed to refrain from fishing in international waters in two large zones in the Gulf of Alaska during the first 15 days of the halibut fishing season. The agreement also contains provisions protecting U. S. fisheries off Washington and Oregon. This 1-year agreement was extended for a second year at negotiations in late 1967.

U. S.-Japan Contiguous Fishery Zone Agreement

In May 1967, the U. S. and Japan negotiated a 2-year agreement permitting the Japanese to continue crab fishing in the 3- to 12-mile zone off the Pribilof Islands, trawl fishing along the Aleutian Islands except during specified periods in zones in the eastern and central Aleutians, and whaling along Alaska's coast except in a portion of the Gulf of Alaska (fig. 8). The Japanese were permitted to conduct salmon fishing operations in the contiguous zone off the Aleutian Islands west of long. 175° W. (provisional line specified in the International North Pacific Fisheries Convention). They agreed to conduct their salmon operations with due regard to the conditions of the runs of salmon of Alaskan origin.

Japan was also granted authorization to conduct loading and support operations within the contiguous zone in two areas in the Gulf of Alaska: (1) off Kayak Island, and (2) off Sanak Island. Except for Alaska, no recognition was given to continued Japanese fishing inside the U. S. 3- to 12-mile fishery zone of the contiguous 48 States of the U. S. and Hawaii.

The agreement also provided that Japan refrain from fishing during the first 15 days of the U. S. halibut season in the two zones off Kodiak described in the Soviet agreement. Further, Japan agreed not to fish from September through February in: (1) the six crab pot zones surrounding Kodiak Island, the boundaries of which are identical to those established by the 1964 U. S.-USSR agreement, and (2) a zone south of Unimak Island and the eastern Fox Islands used extensively by the U. S. king crab pot fishermen. Prior to the agreement's expiration, the parties are to review it and discuss possible arrangements for continued Japanese fishing.

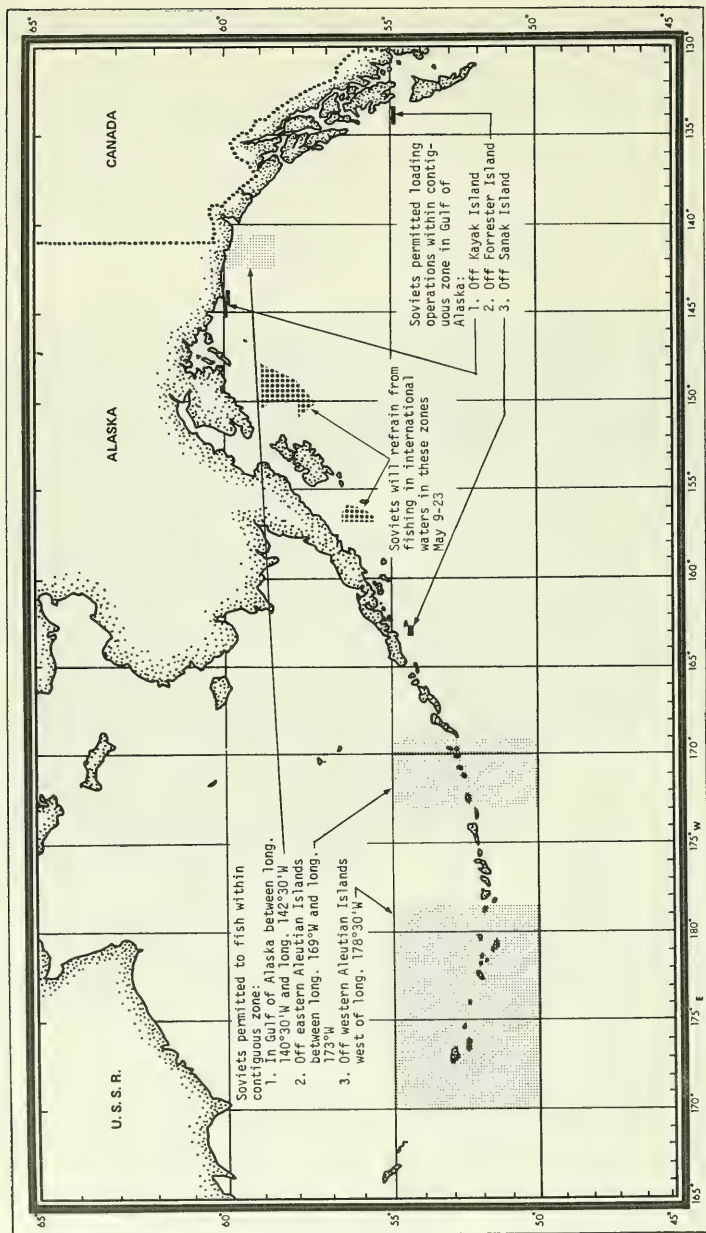


Fig. 7 - Fishing and loading areas established by 1967 U.S.-USSR contiguous fishery zone agreement.

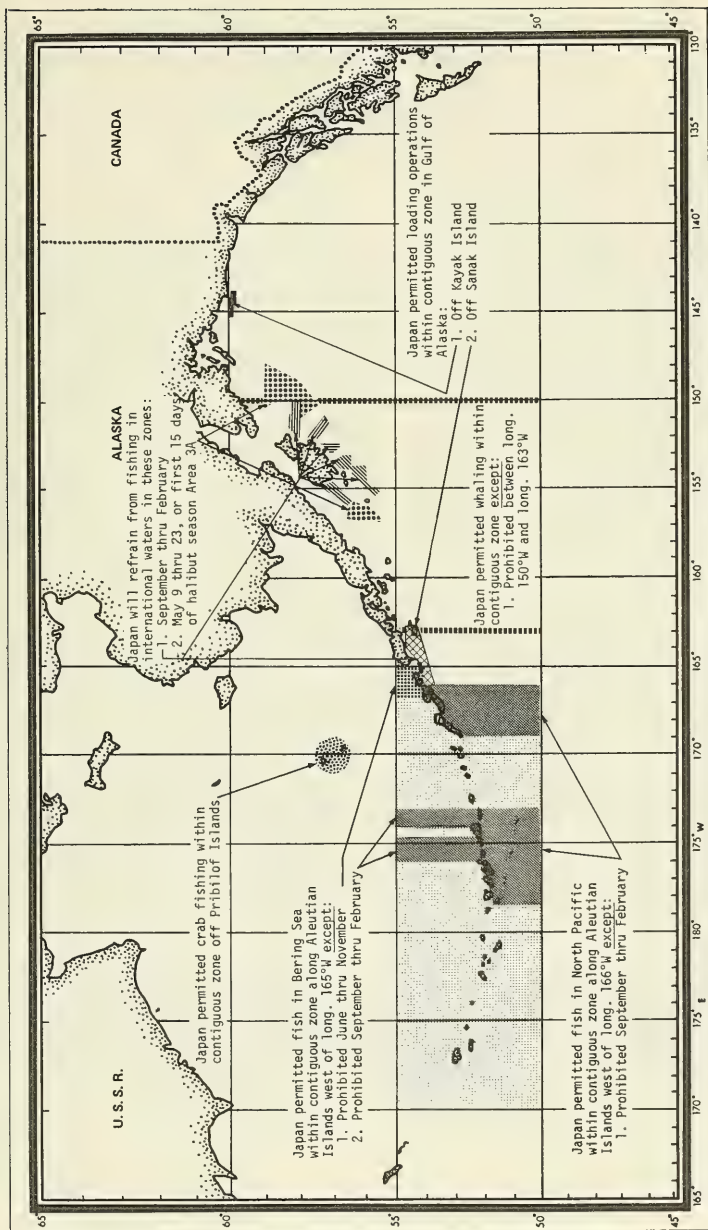


Fig. 8 - Fishing and loading areas established by 1967 U. S. - Japan contiguous fishery zone agreement.

POLICING OF FISHERIES AGREEMENTS

U. S. responsibilities for policing the international agreements and for enforcing the U. S. laws and regulations implementing the agreements lie with the Bureau of Commercial Fisheries and the Coast Guard. In 1960, with the increasingly evident threat posed by foreign fleets, BCF and the Coast Guard initiated a system of joint Alaskan international fisheries patrols. Coast Guard fisheries patrol ships and aircraft are accompanied by BCF fisheries enforcement agents. In addition to enforcement, the joint patrols gather information on foreign fisheries not subject to international agreements. This is done to help determine their impact on fishery stocks of current or potential value to the U. S. Such information is essential to formulate U. S. national and international fisheries policies.

To keep pace with the increasing foreign fisheries and the obligations imposed by additional agreements, the joint Coast Guard-BCF patrols have been increased from a few weeks by a single ship in 1960 to year-round

surface and aerial patrols. During the past few years, Coast Guard cutters, augmented by aircraft from Annette and Kodiak Islands, annually logged about 250,000 miles (10 times around the earth) on international fisheries patrols off Alaska.

CONCLUSIONS

Historically, international agreements have played a significant role in Alaskan fisheries. Within the past few years, such agreements have been relied upon increasingly to protect U. S. fisheries confronted with continual competition by burgeoning Soviet and Japanese fleets. As the world turns increasingly to the living marine resources of the seas as a source of food, the fishery resources on the vast Continental Shelf off Alaska will be subjected to more and more intensive foreign fishing efforts. There can be little doubt that bilateral and multilateral fishery agreements will assume even greater importance in preventing foreign encroachment on the stocks and fishing grounds essential to the maintenance and growth of a viable U. S. fishing industry in the Alaska area.

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BOTTOM LONGLINE EXPLORATIONS IN THE GULF OF MEXICO

A Report on "Oregon II's" First Cruise

By Walter R. Nelson* and James S. Carpenter**

The BCF Exploratory Fishing and Gear Research Base at Pascagoula, Miss., has been concerned with improving the harvest and harvesting methods of the snapper industry and locating stocks of bottomfish not now used as food. In 1960, Captiva and Rivers reported on the practical use of roller-rigged fish trawls for catching snappers and groupers, but this method has not yet been accepted by the industry.

Recent emphasis has been placed on bottomfish explorations with longline gear along the edge of the Continental Shelf and upper Continental Slope, an area that has received only token coverage. Shrimp and snapper explorations have been confined generally to depths less than 50 fathoms; royal-red shrimp

explorations have been carried out mainly in depths greater than 200 fathoms. Limited sampling has been done in the 50- to 200-fathom depth range with shrimp trawls, which are not efficient for catching large mobile fish.

Segments (Trips 3 and 7) of Cruise 1 of the R/V Oregon II (fig. 1) were designed to add knowledge of bottomfish stocks within the 50- to 200-fathom depth range, to determine the availability of deepwater bottomfish to longline gear, and to evaluate the commercial feasibility of this gear.

These trips were concerned with exploring for new fishery resources in the Gulf of Mexico. Coverage, not maximum production,



Fig. 1 - The R/V Oregon II, the new, 170-foot, multipurpose fishing vessel of BCF's Exploratory Fishing and Gear Research Base at Pascagoula, Miss. She will conduct exploratory work in the Gulf, Caribbean, and South Atlantic.

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was emphasized. The catch rates would have been higher had we sampled intensively those areas where large catches were made. Also, the gear used was a rather small sampling unit designed for a rapid survey.

GEAR

The bottom longline or "trawlline" consisted of three 100-hook baskets of gear shackled together. One basket each of sizes 6, 7, and 9 circle hooks baited with squid or ladyfish was fished at each station. Hooks on

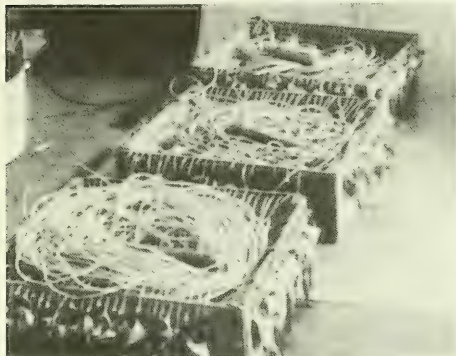


Fig. 2 - Longline gear ready to be set off the stern of the R/V Oregon II.

6- to 12-inch monofilament gangions were attached at 10-foot intervals to a $\frac{1}{4}$ -inch polydactylene or nylon mainline. The line was coiled in shallow wooden notched boxes and set off the stern (fig. 2). Fishing time varied from 1 to 2 hours. The gear was retrieved with a Japanese longline hauler designed for tuna and swordfish longlines. The short gangions and circle hooks went through the roller and hauler easily, so the fishermen had to handle the line only when removing fish (fig. 3). Including running time between stations, as many as 8 gear sets were made within a 24-hour period.

The only sizable losses of gear occurred when sets were made on snapper lumps. There, hangups were frequent. Jarvis, in 1935, and Whiteleather and Brown, in 1945, reported large gear losses from bottom longline sets made on rough bottom in the Gulf and Caribbean. Most of the Oregon II sets, however, were made off coral areas and little fouling took place. Overall, only about 2 percent of the total hooks fished were lost.

AREA FISHED

Exploratory fishing was conducted off Texas and Louisiana, the northern edge of the Campeche Bank, the west coast of Florida and in the northern Gulf from Cape San Blas, Fla., to the mouth of the Mississippi River (fig. 4). Fishing was done off the Texas and west



Fig. 3 - Removing small fish from longline. Short gangions went through the roller (on the rail) and longline hauler (right) without fouling.

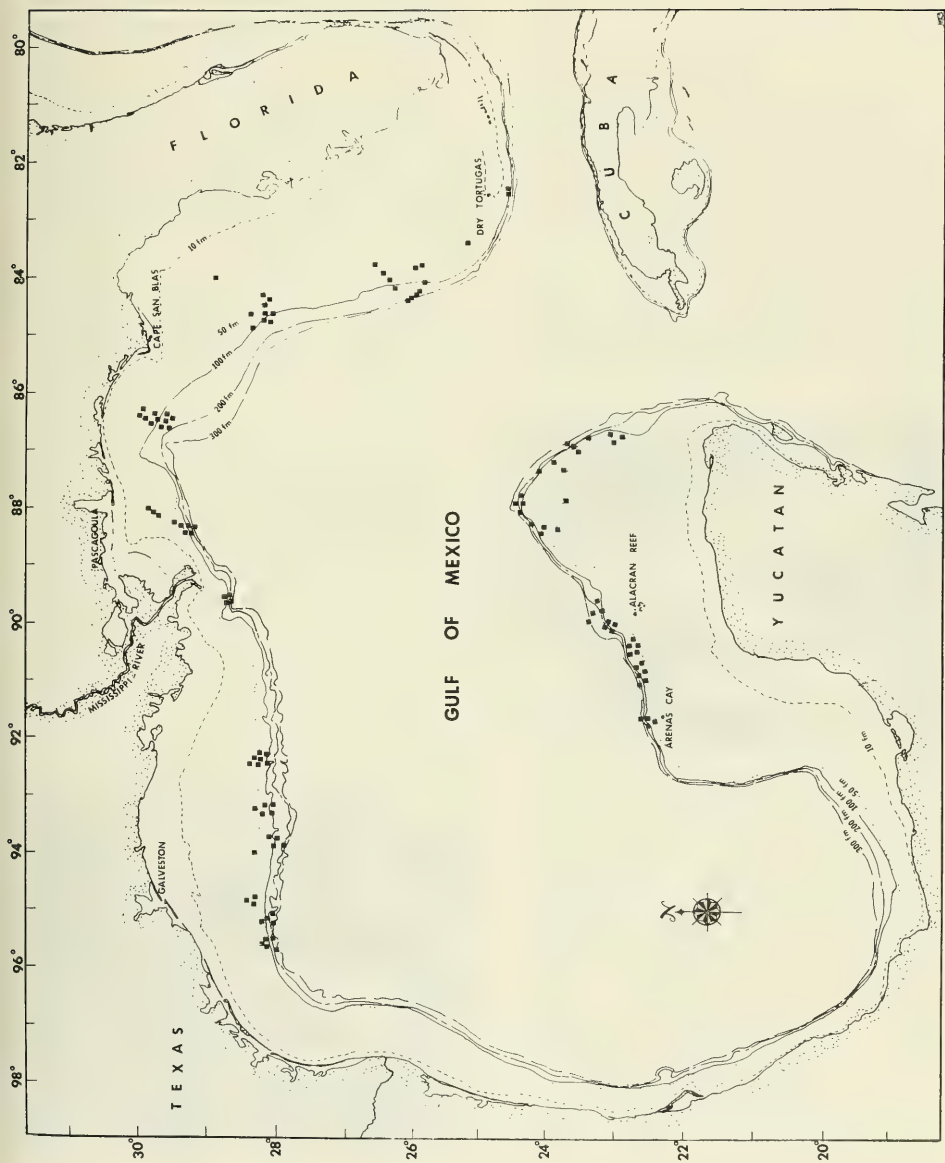


Fig. 4 - Bottom longline sets made on R/V Oregon II's Cruise 1.

Louisiana coasts in October 1967 and through the other areas in January 1968.

RESULTS

The most abundant food species by number and weight was the tilefish, Lopholatilus chamaeleonticeps (table 1, fig. 5). This valuable foodfish species has been taken commercially off the Middle Atlantic States since the early 1900's (Bigelow and Schroeder, 1953). Small tilefish have been taken occasionally during deepwater explorations in the Gulf with shrimp trawls, but never in abundance. Fishery statistics show that a few thousand pounds of tilefish are landed yearly at Florida ports, but these fish are taken in small numbers by snapper fishermen. The species previously had not been considered to be of potential commercial importance as a separate fishery.

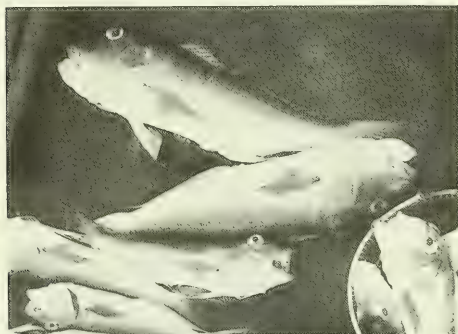


Fig. 5 - The tilefish, Lopholatilus chamaeleonticeps.

Tilefish were taken in all Gulf areas. A total of 285 tilefish weighing 1,695 pounds were caught at 48 stations. The fish ranged from 1 to 27 pounds and averaged 6 pounds. Tilefish were caught on 28 of 39 longline sets in depths of 150 to 200 fathoms, the depth range of greatest abundance. Total depth range was 90 to 225 fathoms. Tilefish were taken over a temperature range of 50° to 63° F., but they were most abundant in a narrow range of 55° to 57° F. They were caught only once in depths greater than 200 fathoms, even though several deeper stations had temperatures in the optimum range; they were caught only twice at depths less than 125 fathoms, although numerous shallower sets were made in waters of less than 63° F. The distribution of tilefish appears, therefore, to be affected by both depth and temperature.

Small tilefish were taken occasionally on several consecutive hooks. This indicated they may exhibit schooling behavior. Large individuals, however, were widely separated on the line.

No large concentrations of fish were indicated on depth recorder tracings in areas where tilefish were taken. Individual fish picked up on an oscilloscope proved to be small sharks when sets were made. No indication was found that tilefish occur in dense concentrations as do some other bottom species.

Tilefish appeared to be more abundant on rough bottom or on moderate to steep slopes than on broad expanses of smooth bottom. This phenomenon might be due to either habitat preference or food availability.

Because information was gathered only in October and January, nothing is known of the distribution and abundance of tilefish during other months. However, the environment should be fairly stable at depths of 150 to 200 fathoms and any major seasonal changes would be unexpected.

Highest catches of tilefish were made off the Texas coast. The largest catch of 285 pounds was made at 150 fathoms, followed by a 217-pound catch at 190 fathoms (fig. 6). Average catches (table 2) approached $\frac{1}{2}$ pound per hook at 200 fathoms. All 6 sets between 150 and 200 fathoms off Texas caught tilefish.

Next in tilefish abundance was the Campeche Bank. The largest catch was 12 tilefish weighing 166 pounds. All 8 sets at about

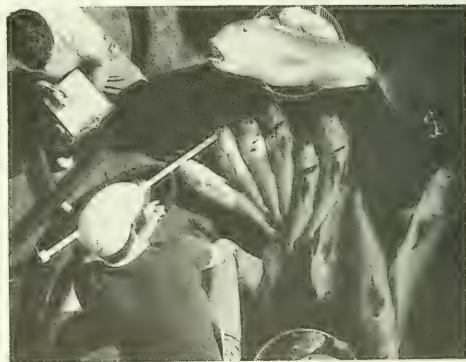


Fig. 6 - Tilefish taken on one 300-hook set off Texas.

150 fathoms took tilefish. Few tilefish were taken east of Alacran Reef, but the catch averaged $23\frac{1}{2}$ pounds per 100 hooks west of Alacran Reef. The heaviest concentration was north of Arenas Cay.

In the northern Gulf, tilefish were taken off the mouth of the Mississippi River and along the eastern edge of DeSoto Canyon. The largest catch per 300-hook set was 14 fish weighing 104 pounds at 175 fathoms, the depth of greatest abundance. Central and western portions of DeSoto Canyon were not sampled, but it is quite probable that tilefish inhabit the entire canyon area off northwest Florida.

Only 3 tilefish were caught off the west coast of Florida, from 125 to 225 fathoms. The catch, although low, at least showed tilefish in the area. Concentrated stocks may have been missed because of limited sampling.

The other foodfish found in some abundance was the yellowedge grouper, Epinephelus flavolimbatus, which accounted for over 50 percent of the total weight of all species of groupers. In contrast to most species of groupers, the yellowedge was not limited to rough terrain. It was caught frequently in areas of flat smooth bottom. A total of 113 fish weighing 1,168 pounds was taken at 21 stations over a depth range of 70 to 150 fathoms. The fish were relatively large: average weight was 10 pounds, size range 4 to 20 pounds.

Yellowedge grouper were abundant in only 2 Gulf areas. Highest catches were made off Texas--one set at 100 fathoms yielded 24 fish weighing 271 pounds. The largest catch on the Campeche Bank was a 105-pound catch made on the northwestern edge. Only 3 yellowedge groupers were caught in the northern Gulf, and none was taken from the west coast of Florida.

The warsaw grouper, E. nigritus, was next in importance to the yellowedge grouper off Texas and on Campeche Bank. At depths of 100 to 125 fathoms, the average catch per 100 hooks for the 2 areas was 10 pounds and 12 pounds, respectively.

Moderate numbers of the gray tilefish, Caulolatilus microps, were taken on east Campeche Bank from 75 to 125 fathoms. The largest catch was 125 pounds at 125 fathoms. Average size was 6 pounds and size range

was 1 to 15 pounds. This species is not listed in American Fisheries Society Special Publication No. 2 (1960). We are proposing the common name "gray tilefish" because of its distinctive coloration. In a few instances, tilefish and gray tilefish were taken on the same set, but generally their ranges did not overlap.

Other foodfishes taken in small quantities were red snapper, vermilion snapper, wenchman, scamp, red grouper, black grouper, porgies, and Gulf hake.

Sharks constituted the largest single bottomfish component (table 1)--32 percent of the total bottomfish catch. Over half the sharks were taken from the northern Gulf area. The catch comprised dogfish sharks, Squalus and Centrophorus, and smoothhounds, Mustelus, averaging about 4 pounds.

Off the Texas coast where catch rates were highest, foodfish constituted 77 percent of the total catch; they accounted for about one-half of the total foodfish catch for all Gulf areas, although only about one-fourth the total effort was expended off Texas (table 1). Peaks in foodfish abundance off Texas were found at about 100 and 200 fathoms (table 2). Several species of groupers (mostly yellowedge grouper) were predominant in the 100- to 125-fathom depth range. They were replaced by tilefish in deeper waters.

On the Campeche Bank, the second most productive foodfish area, most foodfish were taken west of Alacran Reef. As occurred off Texas, groupers dominated shallower areas, and were replaced by tilefish beyond 125 fathoms. Foodfish constituted 74 percent of the total catch, but they were relatively abundant only around 125 fathoms (table 2).

The north Gulf catch was comprised primarily of sharks; the tilefish was the only foodfish taken in any abundance (table 1). The other foodfish category, for the most part (table 2), consisted of Gulf hake.

Catches were extremely low off the west coast of Florida for all depths and all species.

COMMERCIAL CONSIDERATIONS

Our longlining results agree with those of earlier workers (Jarvis, 1935; Whiteleather and Brown, 1945) in that longline gear does not appear commercially feasible for catching

snappers, but it may have some application for groupers. A number of sets were made on rough bottom within the depth range inhabited by red snapper, *Lutjanus campechanus*, and silk snapper, *Lutjanus vivanus*. However, only 1 silk snapper and 65 red snappers were caught during the entire cruise. Grouper catches were higher, but these approached possible commercial concentrations only off Texas in about 100 fathoms.

The apparent absence of dense schooling behavior in large tilefish makes it unlikely that they would support a handline fishery. A longline covers a relatively larger area of bottom than do handlines. It should provide higher catch rates per unit of effort. Our catch rates made in areas of greatest concentration off Texas compare favorably with an early report on longline catches of 30 to 40 tilefish per 400 to 500 hooks off the Middle Atlantic States (Bumpus, 1899).

The Texas coast is the only part of the Gulf that appears to offer commercial potential with longlines. Certainly a large number of hooks would have to be fished. Projections of catch rates presented in this paper indicate that a daily fishing effort of 5,000 hooks should result in average daily catches of about 2,000 to 4,000 pounds of tilefish.

We conclude from the results of Cruise 1 of the R/V Oregon II that the bottom longline is more valuable as a tool for locating and assessing bottomfish stocks than as a method of commercial harvesting by present-day standards.

A trawling potential appears likely throughout the Gulf where the bottom is not excessively rough. Tilefish are taken commercially with trawls in the Middle Atlantic States, so they should be susceptible to trawling in the Gulf. In most areas where tilefish were taken, the bottom was rough or sloping, but little recorded bottom was unsuitable to the use of roller-rigged fish trawls. Certainly a tilefish potential exists. Future deep-water fish trawling cruises in the Gulf by the R/V Oregon II are scheduled to determine the feasibility of a trawl fishery for this foodfish.

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A detailed fishing log (table 3) showing geographic position, depth, date, catch and related data for each set is available as an appendix to the reprint (Sep. No. 826) of this article. Tables 1 and 2 are also in the reprint. For a free copy of the Separate, write to Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209.

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INTERNATIONAL

ICNAF Holds 1968 Annual Meeting in London

The International Commission for the Northwest Atlantic Fisheries (ICNAF), which held its annual meeting in London, June 4-8, reported that the catch of traditional fish species in the Northwest Atlantic increased by about 4 percent--to 3,331,000 metric tons--from 1966 to 1967. Increases were noticeable particularly in the Greenland, Labrador, and Newfoundland areas. There was a decrease in catch of cod, haddock, and flatfish in the Gulf of St. Lawrence, Nova Scotia Banks, and Gulf of Maine areas.

Intensity of Fishing

Scientific assessments of the major exploited fish stocks indicate that in the Greenland-area cod and Georges Bank-haddock fisheries, intensity of fishing has reached, and may have exceeded, levels giving the largest sustainable catches. The same, or higher, average catch could be achieved with less intensity at considerably less cost.

Several delegations consider that high-seas fishing for Atlantic salmon either should be prohibited or stabilized at present level.

New Proposal for Regulation

The Commission examined a proposal to add economic and technical considerations to the present scientific investigations--on which proposals for new regulatory measures are based. Member governments have been invited to consider the proposal for further discussion at the 1969 annual meeting.

A joint U. S.-USSR survey of the Georges Bank-Gulf of Maine area is providing important information on research techniques and gear to be used in studies of year-to-year abundance of haddock stocks.

Otter Trawl Gear Size

The minimum mesh size in otter-trawl gear became an effective international regulatory measure for major commercial species throughout the Northwest Atlantic area on Sept. 24.

The 1969 meeting will be held in Warsaw, June 2-7. The Commission accepted an invitation from Canada to hold its 1970 meeting in St. John's, Newfoundland.



Indo-Norwegian Project Spurs Investment in Fishing

The Indo-Norwegian Project (INP) begun in 1952 is a comprehensive program designed to develop deep-sea fishing in India. Its aims are to improve offshore fishing techniques, fish processing and curing techniques, construct ice plants and fish freezing and storage facilities, establish boatbuilding yards, and train fishermen.

Norway supplies machinery and equipment, including technical personnel, for local operation of project facilities and training, both in India and abroad.

India provides sites and utilities for projects, construction and building materials, labor, technical and administrative personnel, and pays rupee costs of Norwegian personnel. The project has been expanded to include exploratory and hydrographic surveys of fishing grounds.

Discover New Shrimp Resource

INP vessels have found major new shrimp grounds at 900 to 1,200 feet about 1,000 square miles off Quilon coast of Kerala. Fishing has yielded 1,760 lbs./hr. of large shrimp. The new grounds could revolutionize the local industry.

Plans for Indian-Built Trawlers

INP is offering local shipyards designs for the 70- to 90-foot-long steel-hulled vessels needed to trawl at 1,200 feet. The government insists that a third or more of all trawlers must be built in India, although cost of locally made hulls is about 50 percent higher than European-built vessels.

Giovanola Binny Ltd., Kerala, has decided tentatively to begin construction of large

steel-hulled trawlers. The firm expects to quote prices comparable to those of imported vessels. Binny estimates the demand for such trawlers will expand as local firms learn the advantages of exploiting sea resources with larger mechanized craft.

Other Activities

Preliminary INP surveys indicate that shrimp fishing off the eastern coast of India should be as good as off Kerala coast. In Madras State, INP is presently erecting a boat-building yard for small motorized craft, a 50-ton-a-day fish-meal plant, a 100-ton fish-freezing plant, and a training and servicing center for fishermen. INP also is scheduled to survey fishing prospects off Madras. (U. S. Consul, Madras, June 26.)



FPC Market Survey Set for Chile and S. Korea

The Agency for International Development (AID) has awarded its first contract for studies of the commercial marketing potential of fish protein concentrate (FPC). Under a \$268,073 contract General Oceanology, Inc., of Cambridge, Mass., will conduct feasibility studies in Chile and South Korea over the next year.

AID Donations of FPC

Dr. H. Brooks James, AID assistant administrator for the War on Hunger, described the study as an important step toward introduction of relatively low-cost, high nutrition, foods in developing countries.

In April, AID contracted with Alpine Marine Protein Industries, Inc., of New Bedford, Mass., to produce FPC for use in AID-administered Food for Freedom donation programs in developing countries.

Survey Aims

General Oceanology will determine whether the market potential for FPC in Chile and South Korea justifies commercial development. These countries were selected because of their relatively advanced fisheries. The survey will analyze such factors as consumer and market characteristics, acceptability of

FPC-fortified foods, and production costs in relation to the market. Results are expected to provide a basis for planning the development of FPC industries by private industry and Chile and S. Korea.



U. S. Helps Thailand Develop Fish Protein Supplements

The Agency for International Development (AID) is readying a project to improve nutrition in rural areas of Thailand. The project also will develop inexpensive high protein food supplements, especially for preschool children in the northeastern regions. Called "Protein Food Development," the project will run from 1969 to 1971. The U. S. has committed \$225,000. Thailand will contribute \$325,000; \$175,000 in counterpart funds and \$150,000 in cash.

Protein Deficiency in Northeast

Thailand is a major rice producer and generally has a favorable food supply. But large areas, particularly the northeast, are protein deficient. Children 1 to 4 years are hardest hit by this deficiency. Up to 50% of preschool children in northeastern and northern rural areas suffer from protein and caloric malnutrition.

Marine Fish Provide Protein

In developing the supplements from local protein foods, emphasis will be placed on marine fish, one of the Thai foods best suited for the purpose. From 1960 to 1967, Thailand's annual marine fish catch increased from 250,000 metric tons to nearly 600,000 tons. Improved fishing methods could double the catch.

Protein necessary to offset nutritional deficits for 1.6 million children could be supplied from only 265,000 tons of fresh marine fish, or 16,000 tons of dried fish. This would be less than 5% of the present annual catch and considerably less than the tonnage increase each year. Poor marketing and distribution keep processed and fresh marine fish from reaching protein-deficient provinces. Only areas near the main railroad centers have a constant, reasonably priced, supply of marine products.

Distribution A Problem

Supplying fresh-water fish is not a solution. The fresh-water catch is only about 100,000 tons per year and the wholesale price is more than twice that of marine fish. Although it is mainly a question of supply and demand, the result is that those in the North and Northeast must pay twice as much for fish protein as those living in the southern and coastal areas. It is significant that the incidence of protein malnutrition in the north-eastern provinces correlates roughly with the availability and cost of fishery products. The AID project should help insure better distribution. (U.S. Embassy, Bangkok, July 24.)



European-Caught Fish Transshipped from St. Pierre & Miquelon Islands

The French islands of St. Pierre and Miquelon, 12 miles off Newfoundland, have begun major transshipments of European-caught fish. Transshipments are forbidden in Canadian ports.

Transshipment from St. Pierre nullifies much of Canada's advantage in being close to the rich Grand Banks fishing grounds. European deep-sea trawlers will be able to fish almost as steadily as Canadian-based vessels. These European vessels no longer are forced to return across the Atlantic or head south for the big U. S. fish market once their holds are full. They can put into St. Pierre and transfer fish directly to waiting freighters--or stockpile them for later pickup. After stocking up with food and fuel, the trawlers can return to fishing. Within the last 2 years, St. Pierre has become a nearly complete marine service station for big trawler fleets fishing the Grand Banks. Transshipment was practiced here before--but never on the present large scale.

Large Investment

This bolstering of the marine cornerstone of St. Pierre's economy, aided by France's Common Market partners, has involved much money.

Common market money also has helped to build a waterfront marine sciences laboratory

to serve European fishing interests. It will employ 16 French scientists.

W. German & Spanish Fleets

West German and Spanish fishing fleets have set up complete operational bases. Such bases were common in St. John's until recently, but they are becoming rare sights in Newfoundland ports.

The Spaniards apparently plan no major transshipments from St. Pierre. They have established a fully equipped supply base to fill food and fuel needs of their Grand Banks fleet.

The West Germans transfer frozen fish blocks directly from trawlers to freighters in St. Pierre's harbor. In one month, over 40,000 barrels of West German-caught pickled herring were stockpiled on the waterfront to await transshipment home.



FAO Caribbean Project Issues First-Half 1968 Report

During Feb.-June 1968, the "Alcyon," one of the 3 vessels connected with the UNDP/FAO Caribbean Fisheries Development Project, completed wide-ranging exploration and experimental fishing of demersal fish in the northern part of the Project area. Two of the 4 cruises completed were designed to improve fishing techniques. The planners hoped these would provide catches which might increase West Indian use of the resources. The Alcyon fished independently and also acted as "mothership" or base for up to 3 small boats.

Earlier Cruises

Earlier cruises had explored waters southwest of Jamaica, northeast of Hispaniola, and east of Puerto Rico. During a February cruise, exploratory snapper fishing was carried out on the western edge of Pedro Bank, Rosalind Bank and along edge of the Continental Shelf east of Nicaragua. The primary aim was coverage and familiarization with the grounds. Over 10,000 pounds of fish were caught in operations divided between day and night fishing. Almost 60 percent of the catch was snapper (chiefly silk, blackfin, black, and yellowtail) and much of the remainder was jacks (Carangidae).

A March-April cruise extended exploratory fishing for snapper and related species along the northeast coast of Hispaniola and in waters adjacent to the Virgin and Northern Leeward Islands. Over 20,000 pounds of fish, mostly snapper, were taken. Fishing was excellent near Monti Cristi and Navidad Banks north of Dominican Republic, near Sombrero Cay, and on Anguilla and Barracuda Banks east of the Virgin Islands.

Southwest of Jamaica

In May and June, 2 cruises were made with auxiliary small craft operating from the mothership Alcyon. One cruise used one dory and one local-style (Jamaica) canoe. After 12 days fishing southwest of Jamaica, from Alice Shoal to edge of Central American Continental Shelf (about 14°30' N.) 23,398 pounds of fish were recorded aboard the Alcyon. Highest catch for a 24-hour period was 5,281 pounds. Over 60 percent of the catch was taken by fishing from Alcyon, the remainder by the small boats. Principal species were horse-eye jack and mutton snapper, averaging 10-14 pounds each.

On the other cruise, a second dory was added. Six days of hand-lining and incidental trolling produced 5,085 fish weighing 18,042 lbs. The Alcyon and one dory manned by crew members and a trainee caught 2,779 fish weighing 10,211 lbs. The other dory, manned by 2 Manchioneal (Jamaican) fishermen, caught 961 fish weighing 3,459 lbs.; the canoe with 2 Port Royal fishermen took 1,345 fish weighing 4,393 lbs. The boats manned by local fishermen were equipped with one hand-operated reel (Norwegian type) and conventional hand-line gear.

The Catch

The 4,927 fish (17,326 lbs.) caught by mechanical reels and handlines were, by weight, 89.1 percent jacks, 5.1 percent snapper, and 5.8 percent other fish, such as grunts, groupers, triggerfishes. Prominent species of jacks were green jack, 35.8 percent by weight, and horse-eye jack, 53.4 percent, with a trace of amber jack, almaco jack, and bluntnose jack.

Much fishing was done with mechanical hand reels, equipped with 160 fathoms of wire, and capable of fishing to 140-150 fathoms. Silk (yellow-eye) snapper were taken from greater depths (90-140 fathoms) than

other snapper species; blackfin snapper ranged between silk and black snapper (about 40-80 fathoms). The heavy catches of jacks were in 24-30 fathoms, using both reels and hand lines. Squid was the primary bait used. (UNDP/FAO Caribbean Fishery Department Project, July 19.)



Soviets Seize 4 Norwegian Vessels

Two Norwegian vessels seining for herring in the Barents Sea were seized by Soviet fishery patrol vessels on July 16. Soviet authorities reported to Norwegian Border Commissioner A. Rygg the seizure of "Onny Harder" of Baatsfjord inside Soviet territorial waters at 70°3'30" N., 31°47' E. "Egil" of Vadsø was seized the same day.

Fined and Released

The 2 vessels have been released. Fines were 110,000 kroner (US\$15,416). The vessels also had to surrender their nets. Norwegian authorities say the vessels were in Soviet territorial waters; "only the nets," say the owners.

Holding 2 Other Vessels

A third Norwegian fishing vessel seized in early July was not released as of mid-August. The fourth vessel was seized on August 5. Soviet officials told the Border Commissioner to maintain tighter control over the herring fleet or face more severe action in the future. Rygg has asked the North Norway Naval Command to police Norwegian vessels fishing near the Soviet 12-mile limit. The Navy replied that it "does not intend to station any . . . vessels permanently in those waters." ("Arbeiderbladet," Aug. 8; U. S. Embassy, Oslo, Aug. 15.)



USSR Seizes Japanese Vessels

Two Japanese herring vessels carrying 38 crewmen were seized by Soviet patrols on May 16 for violating Soviet territorial waters. Thirty-four crewmen were released; the two captains were still being detained at the end of July. The released crewmen were not allowed to return to Japan until August 3.

Five vessels with 33 men were seized off the Soviet Pacific coast on June 1. Tried on July 31 and fined 1.04 million yen (US\$2,888), they were still being held incommunicado aboard their vessels in Nakhodka on August 4.

18 Vessels Seized

According to the Nemuro Maritime Safety Office, the Soviets seized 18 vessels and 131 fishermen between January 1 and July 18. Only 5 vessels and 94 fishermen had been released by July 26. In previous years, even more vessels and men had been detained. Twenty-eight of those fishermen and an unknown number of vessels were still in Soviet custody.

On July 27, a 2-man Hokkaido-based fishing boat was seized off Etorofu (Iturup), the southernmost Kuril Island, for alleged violation of Soviet territorial waters.

Seizures are likely to continue because no peace treaty has been signed and Japan recognizes neither Soviet sovereignty nor 12-mile fishing limits in the southern Kurils. ("Suisan Keizai," July 26.)



High-Seas Salmon Fishing Off Norway Is Good

About 20 Danish and 7 Swedish long-line vessels fished for Atlantic salmon off the west coast of Norway during May. Catches were good, though crews had to work nearly round the clock. The flesh color of the salmon was excellent, but the fish were lean and of much lower quality than Baltic salmon.

Transportation Difficulties

Danish and Swedish fishermen are not permitted to land catch in Norway for transshipment. They must either make the long trip home or pay others to transport their catch. Skippers have found they must allow 3 weeks for the round trip. Sailing time is only 2 weeks, but the crew insists on a week at home. Therefore, skippers prefer to remain on the fishing grounds and ship catches on other vessels. Freight costs amount to about one-third the price paid for the catch in home ports. This makes fishing less profitable.

Norwegian Opposition

Norway opposes high-seas salmon fishing and was planning to discuss with Denmark and Sweden an end to the fishery. (Asst. Regional Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)



Seminar on Marine Radioecology in December

A seminar on Marine Radioecology sponsored by the European Nuclear Energy Agency and the French Commissariat à l'Energie Atomique will be held Dec. 3-6, 1968, at Cherbourg, France. Particular attention will be given to practical aspects of research in marine radioecology relevant to waste disposal operations. (USOECD, Paris, July 9.)



Spain Delivers Vessel to Cuba

The first of 6 fishing vessels built for Cuba by Empresa Naval Espanola Santander was delivered on September 15. The 6 vessels, first of 14 to be built by this shipyard, are part of the 90 Cuba has ordered from Spain.



Japanese Seek Consulate in Alaska

The Japan Fisheries Society has asked the Government to establish a consular office in Kodiak, Alaska, because of the rapidly growing trade between Japan and Alaska. In the 9 years of Alaska's statehood, trade with Japan in fishery products, lumber, and petroleum has increased to over US\$115 million a year. The Society wants consular services to improve and expand trade relations, and to handle problems arising from Japanese vessel operations off Alaska. ("Suisan Nippo," Aug. 22.)





Gill netter on Johnstone Strait, British Columbia. Vancouver Island in background. (Photo: F. Bruce Sanford)

FOREIGN

CANADA

ASSISTS INDIAN FISHERMEN

The Canadian government has established a C\$4.5 million Indian Fishermen's Assistance Program in British Columbia. The 5-year program will be administered by 5-man "Indian Fishermen's Development Board." Funds will be provided by the Department of Indian Affairs, but the Federal Department of Fisheries will administer the program.

Newer Equipment & Training Courses

Loans and grants will be provided to acquire newer, more efficient, vessels and fishing gear and to reconstruct or convert old vessels. Construction of marine railways, vessel repair centers, gear sheds, and dryboat storage facilities at selected villages will help the Indians improve the repair and maintenance of vessels and gear. Training courses will be offered to increase efficiency in fishing enterprises.

Training Courses Underway

Fisheries training courses under this program already have begun. In the 1967/68 winter season, Indian Affairs Branch sponsored 28 courses. Special instruction in navigation, electronics, engine repair, fishing gear, vessel design, and maintenance was provided for about 400 Indians at 14 villages.

Two marine railways were slated to be constructed during the summer at the villages of Cape Mudge and Kitkatla. These installations, costing about \$84,000, will initiate the improvement of Indian fishermen's shore facilities. (Canadian Dept. of Indian Affairs and Northern Development, July 9.)

* * *

AGREEMENT REACHED ON FLOOR-PRICE PLAN

The Canadian government will support groundfish prices in the Atlantic provinces. Payment will be made to processors who will pay higher prices to fishermen. Neither fishermen nor processors like the plan. They agreed to this method of payment primarily

because it reduces the danger of countervailing duties by the U. S. to more obvious government assistance. (U. S. Consul, St. John's, June 13-14.)

* * *

GRANTS FISHERIES DEVELOPMENT LOAN TO TRINIDAD AND TOBAGO

The Secretary of State for External Affairs announced June 14 that Canada will extend C\$3,000,000 in External Aid development loan funds for 5 projects in Trinidad and Tobago. C\$250,000 has been allocated for a fisheries development project. The loan will pay for an advisor on biological fisheries research, Canadian training for research and biological station officials, a trawler, two refrigerated trucks, and technical assistance, including a skipper and an engineer to train a crew for the trawler. All equipment and goods are to be purchased in Canada. The 30-year, 3% interest loans carry a 7-year grace period.

* * *

QUEBEC PLANS SPECIAL SUBSIDY

Quebec is planning a special subsidy for 500 lobster fishermen of the Isles-de-la-Madeleine to encourage them to fish for other species after the lobster season closes. Ordinarily these people, having no alternative to fishing for their livelihood, draw welfare money most of the year. The subsidy will be limited to inshore fishermen who catch between 10,000 and 50,000 lbs. of cod, plaice, and halibut per year in boats less than 50 ft. long. Maximum subsidy would be \$1,500 per boat.

The Isles-de-la-Madeleine have a perennial welfare problem. The plan, which would cost no more than \$360,000, could save the province \$300,000 in welfare payments. (U. S. Consul, Quebec, Aug. 16 & 22.)





Dean of the Helsinki (Finland) fish market. This 87-year-old woman has been selling fish and shellfish for 65 years in the open-air market. She is counting her stock of crabs. (Photo: Edelsberg)

EUROPE

USSR

LARGE PURSE SEINES SLATED FOR MURMANSK FLEET

The Murmansk Fishing Gear Factory has manufactured a purse-seine net over 720 meters (2,362 feet) long and weighing 18 metric tons. It was delivered to the Murmansk trawler fleet; 10 more will be delivered by the end of 1968. Seiners will be capable of fishing below 200 meters (656 feet). ("Vodnyi Transport," May 23.)

Years of Preparation

As early as Sept. 1965, ATLANTNIRO (Atlantic Scientific Research Institute for Fisheries and Oceanography) was testing off Iceland purse seines 650 meters (2,132 feet) long and 170 meters (558 feet) high. In autumn 1966, vessels of the Northern Fisheries Administration were purse seining in the North Atlantic. Results were mixed, mostly due to the inexperience of Soviet fishermen with the method.

The latest tests with large purse seines--700 meters (2,296 feet) long, 160 meters (525 feet) high--manufactured by the Murmansk Fishing Gear Factory were made off Norway in March 1968. Apparently, they were successful. The serial manufacture of the nets followed.

MURMANSK FISHERIES BESET BY PROBLEMS

Plans to introduce changes at the Soviet Northern Fisheries Administration in Murmansk are in full swing, but the fisheries still operate under the old system. Improved planning, revised price indices, catch charts, etc., will not help unless effective measures are taken to improve port, fleet, and fish-processing operations.

Murmansk Port

In the fishing port, unloading vessels takes time as long as in the commercial port, although both ports have identical equipment. Further delays are caused by frequent railroad-car shortages. The delays reduce the

number of fishing vessels at sea. Losses to the industry run into thousands of rubles. Operations at the fish-processing combine are predominantly manual, which make it impossible to increase productivity and profits.

Herring Fishery in Trouble

The herring fishery also is in trouble. Both fleet and fish-processing combine lack facilities for processing large catches. It is unprofitable to expand processing because of high wages authorized in Arctic regions. Elsewhere in the Soviet Union, fish-processing plants are willing to purchase frozen herring at prices considerably below cost. Current herring prices are so low the Murmansk fisheries have lost interest in catching herring.

Only 3 Herring Products Available

Only 3 herring products--fresh-frozen, smoked, and heavy-salted--are readily available despite the fact that 150 have been tested and 20 introduced for mass production. The assortment is determined not by demand but by processing technology; if processing is simple, the product is manufactured. ("Ekonomicheskaja Gazeta," June.)

KALININGRAD-BASED FLEETS ARE IN THE ATLANTIC

In early July, several Kaliningrad-based fishing fleets fished in the Atlantic from Newfoundland to the tropics. One fleet fished for cod, haddock, flounder, and halibut off Newfoundland. Daily catch averaged 200 metric tons of high-quality fish suitable for quick-freezing. One large and 80 medium trawlers took herring and groundfish on Georges Bank. Daily catch exceeded 1,650 tons; part was frozen and part salted. Daily catch was around 450 tons in the southeast Atlantic. The mothership "Larkii Luch" and her fleet fished for tuna in the tropical Atlantic.

Accent Quality

Soviet fishermen are concentrating more on quality of catch. Landings of fish for which domestic demand is low have dropped, while catches of halibut, hake, flounder, mackerel, and cod have been increasing steadily. ("Vodnyi Transport," July 4.)

USSR (Contd.):

TO STUDY PACIFIC FUR SEALS

Soviet scientists aboard the research vessel "Krylatka" this summer studied the migratory routes of fur seals--their movements, numbers, and length of stay at each rookery. They tagged over 1,000 individual seals in the North Pacific. ("Vodnyi Transport," May 21; "Pravda," June 4.)

Study Results

Tagging has made it possible to compile a chart of seal migrations in the Pacific. According to the latest Soviet estimates, fur seal herds on the Commander Islands are growing rapidly. In the past 10 years, they increased fivefold; to 2,500. Soviet scientists claim this is due primarily to the 1957 Convention prohibiting pelagic sealing signed by the U. S., the USSR, Japan, and Canada.

Since early July, U. S. scientists have been visiting the Commander Islands rookeries.

The Vessel

The Krylatka belongs to the research fleet of the Pacific Scientific Research Institute for Fisheries and Oceanography (TINRO). From November 1965 to February 1966, she conducted biological studies on Pacific fur seals in the Sea of Okhotsk and the Sea of Japan. Herds of up to 200 seals were sighted frequently.

* * *

ORDERS 12 REFRIGERATED FISH TRANSPORTS FROM FRANCE

French shipyards will build 12 refrigerated fish carriers for the Soviet Union. The agreement was signed in Moscow in early May 1968. It is the largest order ever placed by the Soviets in France. Spread among 5 shipyards, it amounts to about 460 million French francs (US\$93 million).

These vessels establish 2 new classes and will be "the largest ever designed." They will supply food, fresh water, and fuel to Soviet deep-sea fishing fleets, serve as passenger carriers to exchange fishing crews at sea, and carry home salted or frozen fishery products.

The 12 Vessels

The Soviet order involves:

- (1) Ten vessels, 8,600-10,000 deadweight tons each. Length overall 164 meters or 537.9 feet, speed 17.5 knots 2 engines 5,580 hp. each.
- (2) Two vessels, 12,500-15,000 deadweight tons each. Length overall 186.20 meters (610.7 feet), speed 18.9 knots, 2 engines 7,400 hp. each.

The vessels are scheduled to be delivered to the Soviets between April 1970 and July 1971. ("La Peche Maritime," May 20.)

* * *

CASPIAN HAS CONSERVATION PROBLEMS

The Ministry of Fisheries was criticized in March by the Central Committee of the Communist party for mismanagement of the fish conservation program in the Volga-Caspian Basin. Water pollution, gradual depletion of spawning salmon stocks, and other conservation problems followed erection of a giant hydroelectric power plant on the Volga at Volgograd. The plant reduced the Volga's flow and accelerated contraction of Caspian waters.

Plans for 1971-1975 include construction of channels to bring water from the northern rivers to replenish Caspian water.

Remedies Proposed

The State Planning Commission has approved recommendations of the Ministry of Fisheries to improve the situation. These prohibit use in seismic prospecting of explosives and other substances harmful to fish and seek to prevent water pollution from petroleum products, chemicals, and other toxic substances.

The State Supervisory Committee is investigating why a water divider (probably an artificial spawning channel) in the Volga Delta has not been completed. The Ministry of Fisheries has been blamed for holding up completion of the divider by failing to finance excavation of ponds and to develop the Aleksandrov spawning and breeding grounds. ("Ekonomicheskaja Gazeta," March and June 1968.)

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USSR (Contd.):

SURVEY SPINY DOGFISH OFF OREGON

In 1967, Soviet researchers surveyed the area off Oregon and Vancouver Island for spiny dogfish (*Squalus acanthias*). The liver is valued for its high vitamin A content. Schools of commercial importance were found at depths from 246 to 1,476 feet. The largest concentrations were spotted with hydroacoustic devices between 328 and 1,148 feet, where up to 30 metric tons were caught in exploratory 6-minute trawls. Temperatures at the bottom ranged from 6.9° C. to 8.1° C. (44.4°-46.6° F.). In the 30-ton catch area, water temperature was 7.5° C. (45.9° F.).

Lengths and Heights

Lengths varied from 27½ to 33½ inches, with the average 30½ inches; average weights were 5.1 lbs. Stomachs of half the catch were filled with smaller fish and squid. Inadequate knowledge of spiny dogfish biology has kept the Soviets from developing a commercial operation in the area. ("Rybnoe Khoziaistvo," May.)

SCIENTIST SAYS FISHERY STATISTICS ARE POOR

Discussing prospects for marine farming, B. E. Bykhovskii of the Soviet Academy of Sciences said much more must be known about Soviet catches in order to plan for this new field. This is impossible now, he stated, "because fishery statistics are very poorly kept in our nation. These statistics should give precise information about the catch of various species, fishing areas, seasons, and quantitative indices. At present these data are not available." ("Trud," May 9.)

STARTS 'MAN IN THE SEA' PROGRAM

The Soviet underwater research laboratory "Chernomor" was lowered 16 feet into the Black Sea on June 29. Chernomor is a 55-metric-ton steel cylinder, 10 feet in diameter and 26 feet long, and carries a crew of 4. Air comes from high-pressure cylinders. It is equipped with scientific instruments, air purifiers, moisture absorbers, and a hot-water shower.

Its Mission

The crew is to carry out complex oceanologic investigations, observe marine fauna, study the dynamics of bottom-sediment displacements, and test physiologic response of man to an underwater environment.

When the tests at 16 feet are completed, the Chernomor will be lowered 39 to 49 feet for further research. Eight 4-man crews have been trained for the program. ("Sovetskaiia Rossiia," June 28 and 30; "Vodnyi Transport," July 13.)

In late July, a storm in the Black Sea made it necessary to raise the underwater laboratory with its crew. The oceanographic research vessels "Akademik Vavilov" and "Akademik Obruchev" stood by. ("Izvestia," July 25.)

STUDIES EFFECTS OF HOT WATER DISCHARGES ON INLAND WATERS

The Scientific and Technical Council of COMECON, the USSR and East European Common Market, is studying the effects produced by heated water discharged from thermoelectric power stations into inland waters. Discharge of heated water causes substantial changes in the thermal, physico-chemical, and biological conditions of natural reservoirs.

The Council has worked out a research program to: (1) determine thermal changes; (2) study physico-chemical phenomena; (3) determine changes in the biology of natural reservoirs.

Results should be available in early 1969. ("Rybnoe Khoziaistvo," June 1968.)

DISCOVERS 'ECHO-SOUNDER' IN STURGEONS

Soviet biologists have found the sturgeon (*Huso huso*) can emit low-frequency signals and receive their reflections. The scientists believe the fish has an unknown organ that does this. This 'echo-sounder' enables the sturgeon to navigate in the dark.

Discovery of this organ and how it works could open new vistas to radar science. ("Rybnoe Khoziaistvo," May.)

USSR (Contd.):

'AIR CUSHION' DEvised TO CONTROL ICE THICKNESS ON LAKES

Shallow lakes may freeze almost to the bottom and kill fish. To prevent this, a Soviet engineer has suggested pumping air through small holes drilled in the ice after it is 5 to 8 inches thick. If the holes are quickly sealed with clay or wet snow, an air cushion will form under the ice. This would prevent its downward spread and save the fish. If this method works on a large scale, catch yields per hectare may increase considerably. ("Rybnoe Khoziaistvo," May.)



Denmark

GUARANTEES MINIMUM PRICE FOR PLAICE

The Danish Government has appropriated 2 million kroner (US\$267,000) for a pool-fund to assure fishermen a minimum of about 6.1 U. S. cents a pound for the lowest-grade plaice. So long as prices remain above the minimum, fishermen will contribute to the fund about 0.2 cent per pound of plaice landed.

Fishermen's Proposals

Fishermen originally had proposed a minimum price of 1.30 krone per kilogram, and a provision for rationing catches of plaice "in order that supplies could better be adjusted to demand." The government's Monopoly Board refused these proposals. Fishermen say that if the proposals are not accepted they will have to seek government subsidy to survive.

Minimum Prices For Other Species

Government and fishermen representatives have formed a special committee to discuss establishment of minimum prices on other species. (Asst. Regional Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)

DANES BUILD LARGE FISHING PORT

A new port at Hanstholm in northern Denmark is being built at a cost of US\$21.6 million. Seventy of an expected 500 vessels

already are operating out of the nearly completed harbor. Shore-based facilities will be developed next.

Fishing and commercial docks, ice plant, shrimp-processing plant, 2 cod-liver oil factories, and an auction hall already have been completed. A fish meal plant and 2 more auction halls to handle the anticipated large volume of landings are planned for future construction. ("Fishing News International," June 1968.)

CEASES IRRADIATION RESEARCH

The Danish Ministry of Fisheries has terminated research on irradiation preservation. Its reasons: (1) undesirable changes in flavor of irradiated fish products and (2) import of irradiated fisheries commodities is prohibited by most countries. The research yielded much information that will be valuable if work is resumed.

Studies on fresh rainbow trout were carried out at the Risø atomic research station. Normally, the fish can be held in fresh condition for 14 days; irradiation and storage at temperatures just above the freezing point extend this to 21 days. During the last 7 days, however, enzymatic action sometimes causes undesirable flavor changes and lowers overall quality. Net gain for the product from irradiation was considered minimal. (Asst. Reg. Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)

'LIQUIDITY' LOAN TO FISHERMEN IS EXTENDED

Danish fishermen are in trouble because of a long period of declining prices for catches and ever-increasing operating expenses. More than 60 firms supplying fishermen in the north Jutland ports of Skagen, Hirtshals, and Hanstholm have been forced to stop credit because they are extended as far as possible.

New Loans

To ease the situation, the Royal Danish Fisheries Bank is issuing a series of 10-year obligations to help carry fishermen through the difficult period. The program has a limit of US\$3.3 million. (Asst. Regional Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)

Denmark (Contd.):



Fig. 1 - Fishing port of Hirtshals on Northern Coast of Denmark's Jutland Peninsula. About 300 boats, mostly small (19 tons), fish waters of Skagerak, to the east, and North Sea, to the west. Their catches are mostly haddock, herring, plaice, sild, catfish, and shrimp. Part is sold to Britain as industrial fish. (Photos: Edelsberg)



Fig. 2 - Hirtshals. 2 of 3-man crew and son of owner (r). They fish for herring. Father does not want son to be fisherman--job is hard and income uncertain, he says. Each man averages about US\$4,000 a year.



Fig. 3 - The third man checks new 84-meter-long terylene net.

Denmark (Contd.):



Fig. 4 - Hirtshals. 3-man crew of 33-ton fishing vessel catches herring, haddock, whiting, and shrimp. Each man averages US\$4,000-\$5,000 a year.



Fig. 5 - Dragør, near Copenhagen, Denmark. Fisherman (1) is extricating groundfish from tangle net. Ten nets, each 80 meters long, are set at night and pulled in morning.



Fig. 6 - Fisherman lowers net in which to keep fish alive. Part of catch is sold off boat, remainder is trucked to Copenhagen.

Denmark (Contd.):

TRAWLER IS EQUIPPED WITH
TRAWL BLOCK AND FISH PUMP

"Karsten Wernerfelt" from Hirtshals will be the world's first trawler fitted with a new trawl block and hydraulically driven fish pump. The two pieces of equipment, produced by the Norwegian firm A/S Hydema and Co., cost about US\$8,000. The cost can be justified on trawlers of more than 80 gross registered tons.

Operation

The trawl is emptied by bringing it alongside the vessel and attaching a suction hose to the cod end. The other end is lifted with the trawl block, pressing the catch into the intake hose. The 1,400 r.p.m. pump is capable of handling 150 metric tons of fish per hour. A full cod end containing 30 tons can be emptied in 10 to 12 minutes, regardless of weather and sea conditions. Emptying a catch of this size usually requires 4 to 7 hours in bad weather.

Will Lighten Work

The new equipment will replace one crewman and ease the work of the rest. The captain of the Karsten Wernerfelt is enthusiastic about the new equipment; a vessel cannot "wait for weather" if fishing is to be profitable, he said. (Asst. Reg. Fisheries Attache', U. S. Embassy, Copenhagen, July 5.)



Norway

INCREASES SUBSIDIES

The Storting (Parliament) approved unanimously a government proposal to support Norwegian fisheries from June 1, 1968, through May 31, 1969. Total government subsidies are estimated to increase 18% from a year earlier to about US\$32 million for the year ending May 31, 1969.

The exact subsidy amount can only be estimated because first-hand price support payments are based on volume of catches of eligible fish species; also, supports to reduce the cost of tackle, gear, and bait depend on amounts of such items actually bought.

Aid to Vessel Owners

The Storting also has approved a US\$2 million loan arrangement for owners of fishing vessels hurt by this year's failure of the winter herring fishery.

State Supports Continue

The current year, which ends May 31, 1969, completes the 5-year period in which the Norwegian Fishermen's Union and the government pledged to make the fisheries independent of State price support. (This is the General Fisheries Agreement of 1965.)

The agreement's main objective has not been reached. On the contrary, state price support has been rising since 1954/55. This took place despite the fact that deliveries of herring, mackerel, and other fish for reduction purposes have been excluded from price support since 1966.

To Reevaluate Fisheries Soon

Einar Moxnes, Minister of Fisheries, indicated during the Storting debate on the current fisheries subsidy agreement that Norwegian fisheries and, particularly its sales and marketing aspects, would be reevaluated soon. (U. S. Embassy, Oslo, June 25.)



Iceland

HERRING FISHERY STRIKE SETTLED

The herring fishery strike was settled the first week of July when the State Herring Board set the price for raw herring paid by processing plants slightly higher than last year's. Herring-boat owners agreed to some increased wage benefits, and the government agreed to provide financial assistance to vessel owners and processing plants.

The new price, based on the low price for herring oil, promised to benefit neither vessel owners nor processing plants.

Gains for Fishermen

Following the price decision, owners agreed to grant fishermen: (1) increase in life and disability insurance from US\$35,000 to US\$70,000; (2) US\$19 a month for clothing;

Iceland (Contd.):

(3) increased wages of US\$11 a month for engineers, cooks, and net-repairers; and (4) 24 hours' leave after 3 weeks at sea. Also, vessel owners agreed to pay fishermen a fixed amount per barrel of herring salted at sea.

Government Plans Help

At the same time, Eggert G. Thorsteinson, Minister for Fisheries, announced that the government would help herring boat owners and processing plants by easing interest and installments on capital loans. The government would propose in the Althing this fall compensation up to US\$526,000 for the herring industry.



France

FISH INSPECTION

Several agencies share responsibility for fish inspection in France: (1) Institut Scientifique et Technique des Peches Maritimes, Ministere de la Marine Marchande--responsible for sanitary controls at point of manufacture; (2) Service Veterinaire, Ministere de l'Agriculture--in charge of sanitary control of landed fresh fish; (3) Service de la Repression des Fraudes et Controle de la Qualite, Ministere de l'Agriculture--responsible for sanitary control once fish reach the trade; (4) The Ministere des Travaux Publics and the Ministere de la Sante Publique assist the above agencies.

Methods

Fish inspection in France, and her overseas possessions, is mandatory for all products. It applies also to foreign and domestic trade. Laboratory tests are performed periodically at ports of debarkation, canneries, wholesale and retail levels. Most inspectors are agents of the Institut Scientifique et Technique des Peches Maritimes and of the Service Veterinaire. (U. S. Embassy, Paris, July 24.)



Italy

MOTHERSHIPS BUILT

The M/S "Doroty Seconda," a freezer-fishing vessel built for the Sicilian firm OCEANFRIGO by an Italian shipyard, was launched on June 24. Her twin, "Doroty Prima," was launched 3 months earlier.

Specifications are: length between perpendiculars 274 feet; breadth, 40 feet; dead-weight tonnage, 1,550 tons; 2,400-hp. engine capable of 15.7 knots. The vessels are equipped with all the latest instruments and gear. They are supplied with long-line fishing equipment and carry crews of 40. Each has 4 refrigerated holds with varying temperatures and a total capacity of 1,200 tons. Cost is about US\$2.4 million each.

To Be Motherships

The vessels will serve as motherships for a fleet of 4 smaller trawlers, either newly built or used, which OCEANFRIGO is interested in obtaining from foreign sources, including the U. S.

Doroty Prima sailed on her maiden voyage in July. Although equipped to handle all sorts of finfish, she will concentrate on tuna fishing off the African west coast. (U. S. Consul, Palermo, July 10.)



United Kingdom

NEW VESSEL BUILT IN POLAND

The flag was raised on the "Boston York" in the Gdynia Shipyard on June 28. The vessel is the second in the series of B427/A trawlers built there for the owners: Boston Deep Sea Fisheries, Hull, England.

The "Boston Concord" was handed over in 1965. The "Boston Lincoln," prototype of B427/A series trawler, was delivered in April 1968. The Boston York is the third trawler constructed by the Gdynia Shipyard for the Hull company.

Fishing Stern Trawlers

The B427/A type units are fishing stern trawlers designed for North Sea and North

United Kingdom (Contd.):

Atlantic grounds. Length overall is 64.40 meters (211 ft.); breadth 12 meters (39.4 ft.); draught 5.00 meters (16.4 ft.); deadweight 500 tons; speed 14.5 knots; hold capacity about 600 cu. meters (21,189 cu. ft.); crew 26.



A main engine developing 2,500 hp. drives an adjustable pitch propeller through a transmission gear. The latter drives 2 BC generators: one of 315 kw. drives the trawl winch motor, the other of 350 kw. feeds the mains. Insulated holds can store fish on ice, or in a temperature as low as -29°C . (-20.2°F .)

Other Construction

Besides the Boston Lincoln and Boston York, Gdynia Shipyard is constructing 2 modernized trawlers--the B427/B version--for another British owner, Boyd Line Ltd., Hull. ("Polish Maritime News," July 16.)

WHITE FISH AUTHORITY LOWERS INTEREST RATES

The British White Fish Authority lowered its interest rates on fishery loans effective Aug. 10. The action resulted from a change in interest rates by the Treasury.

The new rates are:

Fishing vessels, new engines, nets and gear:

On loans not over 5 years, $8\frac{1}{4}\%$ --decrease $\frac{1}{4}\%$.

On loans over 5 years but not over 10 years, $8\frac{1}{4}\%$ --down $\frac{1}{8}\%$.

On loans over 10 years but not over 15 years, $8\frac{1}{8}\%$ --down $\frac{1}{8}\%$.

On loans over 15 years but not over 20 years, $8\frac{1}{8}\%$ --down $\frac{1}{8}\%$.

Processing Plants

On loans not over 5 years, 9% --down $\frac{1}{4}\%$.

On loans over 5 years but not over 20 years, $8\frac{1}{4}\%$ --down $\frac{1}{8}\%$.

The rates on loans made before Aug. 10 were unchanged. ("Fish Trades Gazette," Aug. 24.)



East Germany

FISHERY TRENDS

East Germany has converted about 10 trawlers for purse seining and is using them to fish herring in the northeast Atlantic between Iceland and Spitsbergen. Total daily catches average about 200 metric tons. Since purse seining is new to East German fishermen, Soviet gear specialists are training them. Twenty regular East German trawlers are processing the catch, and 2 chartered Soviet refrigerated fish carriers are hauling it to Rostock.

Changes in fishing technique and area were caused by reduced catches in East Germany's traditional fishing grounds in the North Sea. ("Berliner Zeitung," June 9; "Neues Deutschland," June 16.)

East Germany (Contd.):

Distant Water Fishing

The Soviets also will deliver a 3,000-gross-ton refrigerated fish transport to the Rostock Fisheries Combine to help East German vessels fishing off East Africa.

Rostock-based vessels were expected to fish Georges Bank during the summer. ("Neues Deutschland," June 16.)

To Use Computers

Under the new economic system, "profits" are more important than production. East Germans plan to equip their high-seas fishing fleets with automated data-processing machinery. Vessels will teletype daily reports on catches, weather, currents, and other data to the mothership. A small computer will process and relay these to home port. There, a larger computer will guide the fleet to the best fishing grounds. The first data processing system is to operate at the Rostock Fisheries Combine. ("Der Morgen," July 11.)



West Germany

INDUSTRY CONSIDERING ON-BOARD IRRADIATION

The president of the Society to Promote the Irradiation of Foodstuffs has outlined the possibilities of improving the efficiency of the W. German deep-sea fishing fleet through irradiation equipment. Irradiation lengthens the storage life of fish. So the time at sea of trawlers operating out of German ports and landing fresh iced fish could be extended from the present 12 to 18 days.

Isotope irradiation equipment for use aboard a trawler would cost about US\$150,000-200,000. The quality of fish treated with radiation would be improved. Such fish would bring higher prices. Equipment capable of processing one ton of fish per hour might be amortized within 18 months, with an additional charge of US\$10 a metric ton.

Government Aid Sought

Relatively small amounts of radiation energy would be used. This would exclude

possibility of harmful radioactive contamination. The Society has requested the government to fund installation of irradiation equipment for testing purposes aboard the government-owned fishery research vessel "Walther Herwig." The Federal Fishery Research Board at Hamburg supports the Society's request.

The Society hopes to bring about amendment of the Food Law that prohibits irradiation of foodstuffs. Existing measuring devices cannot detect radiation treatment permitted by several foreign countries. Therefore, it is possible that irradiated foodstuffs already have been imported into West Germany. (U. S. Consulate, Bremen, June 14.)



Poland

PLANS FISHERY EXPANSION

Polish economists and fishery administrators are planning ahead to 1985. Planning is based on future consumption estimates of about 18-20 kg. (39.6-44 lbs.) per year per capita. However, critics point out that because of many variable factors, such as future income per capita, quality and price of fishery products, etc., it is difficult to predict future demand exactly. Some estimate per-capita consumption as high as 25 kg. (55 lbs.); others believe it will not even reach 18 kg. (39.6 lbs.).

Estimated Production

Preliminary studies by the Institute for Marine Fisheries at Gdynia indicate that the 1965 output of fishery products -- 133,500 metric tons -- will almost double by 1970 to about 240,000 tons, and triple by 1980 to over 400,000 tons. On the basis of these estimates, plans are being made for increases in catch and for new fishing-vessel construction.

Estimated Catch

According to "Polish Maritime News," the 1967 catch amounted to 321,000 metric tons, including small fresh-water catches of 18,000-20,000 metric tons. Planners expect marine fishery catch to increase to 470,000 metric tons in 1970, 880,000 tons in 1980, and 1 million tons in 1985.

Poland (Contd.):

The greatest production increase will be in fish fillets: in 1970, 140,000 tons of the catch will be used for fillets; in 1985 almost half a million tons. Cod, ocean perch, and hake will be the principal species used in fillet production. In 1965, Poland produced 6,400 tons of marketable fillets; by 1970, production will increase to about 42,000 tons.



Czechoslovakia

ACCLIMATIZATION OF FISH IN FISH CULTURE STUDIED

In late November 1967, a Conference on Acclimatization of Fishes related to fish culture was held at the Fisheries Research Institute in Vodnany. The conference focused on culture and diseases of herbivorous fishes.

Over 20 participants discussed how to use the findings of scientists in practical, everyday fish culture. This would increase fish supply in land-locked Czechoslovakia. In 1966, the catch was only 11,500 metric tons; in 1950, it was only 3,500 tons.

Long Imported Fish

For many years, the areas that constitute Czechoslovakia today imported at least 16 fish species for acclimatization. Most came from the U. S. and from the Soviet Union. Overall success was not good. Fish culturists did not know enough about the biology of various species to select the most suitable species and culture areas. ("Bulletin" of Vodnany Fisheries Research Institute, No. 2, 1968.)



Romania

BUYS TRAWLERS FROM POLAND

A state-owned fisheries company has ordered 2 large freezer trawlers from Polish shipyards. The vessels will be used in the Atlantic north of the 20th parallel. They will be delivered in late 1968 and early 1969. (U. S. Embassy, Bucharest, July 12.)

The first two freezer trawlers for Romanian high-seas fisheries were bought in Japan in 1964. Since then, Romania has joined the Tripartite (USSR, Poland, and East Germany) Agreement on Development of High Seas Fisheries. Poland has developed a fishing-vessel building industry among the best in the world. She even exports fishing vessels to Western Europe.

Romanians have fished in ICNAF sub-area 5 sporadically in past years. Lately, they have fished mostly off northern Africa.



Greece

FISHING INDUSTRY HAS PROBLEMS

The fishing industry is complaining that lack of progressive government policies and rising costs of production have cut deeply into profits. Among measures proposed to solve the problems are lowering interest rates on fishery loans, removing restrictions on sales prices, and regularizing loans.

Greece has begun a 5-year development program that may improve conditions. ("Alieia," June.)



LATIN AMERICA

Venezuela

CLAIMS 3-12-MILE TERRITORIAL SEA OFF GUYANA

Venezuela has claimed the waters 3 to 12 miles off a 150-mile stretch of the Guyana coast as Venezuelan territorial sea. She says navigation will not be affected in the area, but foreign fishing will not be allowed. Guyana is the former British colony of British Guiana.

Historical Boundary Dispute

A boundary dispute arose during the last century when both Venezuela and Great Britain claimed the area between the Esequibo River and the current boundary of Venezuela. In 1899, an arbitral commission decided in favor of Britain. Venezuela accepted the decision but later called it unfair. The issue has flared into heated controversy. Venezuela says that until the dispute is settled she will exercise sovereignty in the waters 3-12 miles out of the area--because she, unlike Guyana, claims a 12-mile territorial sea. The claim will have no effect on Guyana's 3-mile territorial sea.

No Effect on U. S. Trawlers

About 200 foreign shrimp trawlers, mainly U. S., operate near the area; most are based in Georgetown, Guyana. Industry sources see no immediate problems because most trawling takes place beyond 12 miles. (U. S. Embassy, Caracas.)



Colombia

NEW FIRM PLANS TO FISH SHRIMP

A new Colombian company, "Fishing Consortium S. A.," plans to start shrimp fishing out of Santa Marta and Buenaventura in late 1969. It will use 15 vessels now being built in Colombian shipyards. Company president Ernesto Restrepo Osario said that almost the entire catch will be exported to the U. S. and would roughly double Colombia's shrimp exports to the U. S. during 1970-1975.

Financing and Management

Authorized and subscribed capital of the new company are US\$2.4 million and \$1.6 million. Equity capital will be about 80 percent private and 20 percent public. In addition, the firm has obtained close to \$1.9 million loan capital.

Foreign Firms Interested

The company has received numerous offers of financial participation or assistance from European countries. Thus far, the operation has been kept strictly Colombian. Management comes primarily from ex-employees of the Financial Corporation of Colombia, a principal stockholder. (U. S. Embassy, Bogota, July 12.)



Ecuador

U. S.-OWNED TUNA FREEZING PLANT OPENS

Del Monte del Ecuador, C.A., formally inaugurated on June 22 its new US\$800,000 tuna-freezing plant in Manta, northwest of Guayaquil on the Pacific Coast, Del Monte is wholly owned by California Packing Co., San Francisco. The U. S.-equipped plant, located on 10 acres of ocean-front land, consists of 8 freezing tanks, each capable of freezing 12 tons of fish in 5 hours, and a 250-ton-capacity storage freezer (-20° F.)

The frozentuna are trucked 2 miles from the plant to Manta's dock. Then they are transported by refrigerator ship to Del Monte's packing plant in Puerto Rico. The Ecuadorean plant employs 50 persons and, indirectly, 300 persons on fishing boats.

Seasonal Fishing

Since tuna fishing is seasonal (the poorest months are January, February, and March) Del Monte's plant is designed to handle either peak or minimum loads. Banks of 2, 4, 6, or all 8 freezing tanks can be operated, depending on the catch. Del Monte owns or has contracts with 20 boats. Operations started May

Ecuador (Contd.):

8. The company plans to freeze 8,000 metric tons of tuna this year and 12,000 tons in 1969.

Seiners to Come

The firm owns 1 purse seiner. It plans to bring down as many as 6 from the U. S. if market conditions are favorable. Each will cost about \$250,000. Del Monte also may install a dock to accommodate the refrigerator ships. This may not be practicable without constructing a breakwater. The sea is often too rough for loading operations.

Del Monte apparently has no plans to establish a tuna-packing plant in Ecuador. It intends to ship all its catch to Puerto Rico for canning. (U. S. Embassy, Quito, June 26.)

* * *

RULING CREATES FAVORABLE MARKET FOR FISH OIL

An August 9 ruling by the Monetary Board of the Central Bank of Ecuador reduced from 140 percent to 50 percent the advance deposit required for imports of various oils and greases, including fish and marine-animal oils. The action apparently was taken in response to greatly increased imports of fish oils, mainly from Peru. For example, fish-oil imports for first-half 1968 totaled 1,552.6 metric tons, compared with 110 tons during the 1967 period and 788.7 tons during all of 1967.

Will Stimulate Market

The reduced advance deposit for items to be imported is expected to stimulate the market even further. Substantial increases in marine-oil imports are expected over the next several years. (Agricultural Attaché, U. S. Embassy, Quito, Aug. 23.)



Peru

ANCHOVY FISHING SEASON OPENS

The anchovy fishing season opened September 1 and most vessels were reported fishing. First reports indicate fishing poor, although that was not unusual for early September.

There were no labor problems because of a 30-day suspension of constitutional guarantees affecting all unions following a transportation workers' strike.

1968 Shipments Ahead of 1967

Fish meal stocks on hand July 31 were 361,977 metric tons; a large percentage was sold in advance. Shipments were 199,111 tons in June and 167,373 tons in July. This brought total 1968 shipments to 1,255,190 tons--about 30 percent ahead of the 883,398 tons shipped during 1967 period.

* * *

TIDAL WAVE DAMAGES FISHING FLEET

The strong tidal wave that recently hit Peru caused damage of over US\$2.5 million to the fishing industry. Thirty-six 100-ton-capacity vessels were hurled onto the beach, driven aground, or otherwise damaged. It was the worst disaster in the fishing industry since 1952. (National Fisheries Society, Aug. 12.)

* * *

FISHERY DEVELOPMENTS

The Fishermen's Union Federation has presented the Boat Owners Association with a long list of demands. These include:

(1) a 56% increase in the per-ton fishermen's share price paid for anchovy; (2) a base salary of US\$5 a day for captains and \$3 for crewmen when fish are not available; (3) profit sharing, and a bonus salary each May 1 (Peru's Labor Day); and (4) a 50-percent increase in pay for trips exceeding 18 hours.

In April, the price paid for anchovy as the fishermen's share was \$2.60 a metric ton.

Plant Bought

Frigorificos Paita, S. A. (FRIPSA) will be purchased by Star-Kist Foods, California, a division of H. J. Heinz. FRIPSA, which has cold-storage facilities, will be used to store frozen yellowfin and skipjack tuna for export.

Giant Anchovy Seines

Rayon Celanese Peruana (RAY CEL) has sold the first 2 of its giant anchovy seines. Each seine is 440 fathoms long by 45 fathoms

Peru (Contd.):

deep and has 3 bunts. Made of knotted webbing, the individual panels of the nets weigh 18,500 pounds each. The seines will be fished from 350-ton wooden vessels. ("Pesca," April.)



Chile

REPORT ON ANCHOVY CATCH,
FISH MEAL AND OIL PRODUCTION

During May, 1,480 tons of fish meal and 120 tons of fish oil were exported from Arica, and 1,960 tons of fish oil from Iquique. The oil, worth US\$249,700, was shipped to the U. S., U. K., West Germany, and the Netherlands.

During January-May, 62,900 tons of fish meal worth \$5,980,000, and 8,400 tons of fish oil worth \$472,700, were exported. Principal fish meal importers were the U. S. (40%) and West Germany (30%). The Netherlands received 96% of the fish oil.

The 147,400-ton June anchovy catch set a record. Despite a sharp reduction in the size of the fishing fleet and in the number of operating plants, 49% more fish meal was produced than in first half of 1967. A marked improvement in raw material yield--20.4% in 1968; 18.6% in 1967--contributed to this increased production. The price per metric

ton of fish meal in June varied between \$117-149. Consolidation of the fish meal industry in the north, aided by the record June catch, has had a favorable effect.



Mexico

FRANCE GIVES TECHNICAL ASSISTANCE

Experimental fishing by French trawlers has produced mixed results. Two vessels, one based at Progreso, Yucatan, the other at Mazatlan, Sinaloa, began operations last winter.

The Progreso project started with considerable fanfare. French fishermen arrived full of enthusiasm, ready to fish for large quantities of low-priced fish on extensive banks. They soon found that local fishermen, interested only in traditional high-priced shrimp and red snapper fisheries, could see no point in searching for low-priced species which they believe, probably are not very abundant anyway. After several cruises, the trawler ran onto a coral reef. Emergency repairs were made and the vessel returned to France.

Success in Mazatlan

The Mazatlan project was so successful that the Mexican government financed an extension. Some Mexican fishermen had expected to explore for shrimp in depths beyond the usual fishing grounds. The French and other fishermen had planned to explore for finfish. Few shrimp and numerous fish were caught, causing mixed emotions. The Mazatlan operation proved that there are enough fish to support large-scale trawling. Catches of mixed species averaged 6 tons daily. About half the species would be acceptable on the Mexican market, the rest could be sold in Europe.

Other Operations

During September, the trawler cooperated in the Gulf of California resource survey, fishing in deeper waters than the smaller Mexican trawlers. Later it will move to Ensenada to explore the trawling possibilities along Baja California's west coast. (Reg-Fisheries Attaché, U. S. Embassy, Mexico, Sept. 12.)



North Chile's Anchovy Catch, Fish Meal and Oil Production, Jan.-June 1966-68 ¹			
	1968	1967	1966
	. . . . . (Metric Tons)		
Anchovy catch:			
June	147,400	91,100	101,100
Jan.-June . . .	523,100	379,000	769,200
Fish meal production:			
June	30,069	16,948	19,031
Jan.-June . . .	101,547	68,018	135,749
Fish meal production from other than anchovy, south of			
Antofagasta:			
June	3,950	2,500	1,400
Jan.-June . . .	18,800	15,050	14,400
Fish oil production:			
June	6,012	1,319	3,253
Jan.-June . . .	14,275	5,914	14,863

¹/Statistics listed as received. Even numbers apparently are rounded.
Source: Instituto de Fomento Pesquero, Informe Mensual No. 6, July 29; U. S. Embassy, Santiago, Aug. 5.

ASIA

Japan

CUT IN FROZEN FISH PRODUCTION IS PROPOSED

Trawl operators are having a harder time because of the shortage of bottomfish in both northern and southern waters and low prices. Yoshinosuke Yamazaki, board chairman of Kokusai Gyogyo, told the heads of such major fishing companies as Taiyo Gyogyo, Nichiro Gyogyo, and Nihon Suisan that "excessive production of frozenfish at the present time calls for some restriction on production and imports." On June 27, the companies discussed the matter with Fishery Agency Director Morimoto.

Financial Losses

According to Yamazaki, the fishing industry suffered a deficit of 5,270 million yen last year due to low prices for frozen fish and increased interest charges on loans and storage. In addition, the industry had 830,000 tons of frozenfish on hand at the end of the year. The recession trend in the market remains unchanged. If it continues, the industry will accumulate a deficit of more than 50,000 million yen.

Controls Requested

Yamazaki considers overproduction of frozen fish the fundamental cause. He has proposed:

Control over production and imports:

- (1) Limit imports to 130,000-150,000 tons.
- (2) Refrain from shipping into Japan fish valued at less than 60,000 yen per ton (small-sized merlusa, red fish, etc.). This is not to apply to Japanese fishing vessels transporting their own catches.
- (3) Refrain from purchasing and transporting by Japanese vessels fish selling for less than 75,000 yen per ton.
- (4) Japanese trawlers based at foreign ports should not ship to Japan fish valued at less than 50,000 yen per ton.

(5) Require all Japanese trawlers to observe mesh restrictions that prevent taking small fish: small merlusa and red fish from Africa, silver cod from Alaska, and flounder from northern waters.

(6) Make every effort to export merlusa filets. The demand for these is increasing in foreign markets. To do it, attention must be given to a vessel's processing facilities and export promotion measures adopted.

(7) Raise money through a 3,000-yen-per-ton tax to set up a compensation fund of about 500 million yen for losses caused by fishing suspensions.

Industry Cooperation

In addition to Yamazaki's proposals, the companies suggested a dumping prohibition and joint shipments of fish from distant waters. The major companies now recognize the need for joint industry action to conserve resources and maintain fish prices. ("Suisan Tsushin," July 6.)

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FROZEN TUNA EXPORTS UP, PRICES DOWN

Frozen tuna exports, which were slow in business year (BY) 1967 ending March 1968, increased sharply in April and May: 18,642 metric tons compared with 12,916 tons during the same period in 1967. The increase was due to good yellowfin catches in the Indian and Atlantic Oceans in April, and to good albacore fishing in the Atlantic from May.

Export prices, however, were sharply below those of 1967. Yellowfin shipments direct from Japan were \$410 a short ton c.i.f., California delivery, compared with \$460 c.i.f. in early 1967. Atlantic albacore transshipments to the U. S., which brought around \$500 per ton c.i.f. in 1967, were about \$450 per ton c.i.f. for large fish, and \$420 per ton for fish under 20 pounds. ("Suisan Tsushin," June 7.)

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Japan (Contd.):

EXPORTS OF CANNED TUNA
IN BRINE TO U. S. SLOW

Exports of canned tuna in brine to the U. S. were very sluggish during April and May, the first 2 months of business year (BY) 1968. Sales contracted by Tokyo Sales Co. totaled about 300,000 cases (48 7-oz. cans), or 10% of the 3-million-case export target for BY 1968. Normally, sales are brisk during April and May when U. S. retailers stock up for summer selling.

Price Reductions Urged

Japanese trading firms attributed the drop to the high price of the Japanese product. They urged substantial price reductions and a vigorous sales-promotion campaign to overcome the slowdown. The Tokyo Sales Co. established export price of US\$11.20 per case f.o.b. for canned solid white meat tuna in brine is around \$14.80 a case on the U. S. wholesale market. This was about \$1.30 higher than the U. S. packer's price for private labels. Price quotations for the institutional pack were \$1-\$1.50 higher than the U. S. packer's price. Therefore, Japanese firms were believed to be contracting sales with U. S. buyers at prices well below the Sales Co.'s quotations.

Packers Disagree

Japanese packers were in a difficult situation. They could not readily agree to a price cut since the raw material was costing them as much as \$467-479 a short ton. This was \$50 a ton too high, even for the established export price level for brine-packed canned tuna. ("Suisan Tsushin," June 6.)

* * *

EXPORTS EXTRA-LARGE
CAN OF BRINE-PACKED TUNA

The Japan Export Tuna Packers Association is encouraging the packing of tuna in brine in an extra-large can to improve sales in the U. S. institutional market--hotels, restaurants, schools, and hospitals. The can, "Special No. 1," holds 2,500 grams (5.5 pounds) drained weight, and 3,000 grams (6.6 pounds) net weight.

The Can's Advantages

Successful marketing of U. S. machine-packed tuna in brine in recent years has created intense competition for the Japanese product in the U. S. market. Japanese packers believe the extra-large can would avoid direct competition with the U. S. pack and might overcome the slowdown of exports to the U. S. The extra-large can reduces packing costs for processors and brings greater profits to users because of lower buying cost and reduced handling time.

Sales Prospects Seem Good

Packers planned to export 1,200 cases of the new pack before September and hoped to export another 2,500 by May 1969. Sales prospects are good because U. S. institutional buyers already have expressed interest in an extra-large can. ("Nihon Suisan Shimbu," July 17; "Suisan Tsushin," July 29.)

* * *

CANNED TUNA PET FOOD
EXPORTS DECLINE

Exports of canned tuna pet food to the U. S., which increased steadily in recent years, are declining. U. S. firms are not buying because the quality of the Japanese product is poor compared to the U. S. pack.

In 1967, Japan exported 1.4 million cases of canned tuna pet food to the U. S. Loss of the U. S. market is likely to be hard on tuna packers. ("Katsuo-maguro Tsushin," June 5.)

* * *

FROZEN SHRIMP IMPORTS DECLINE

Frozen shrimp imports in June totaled 2,324 metric tons valued at about US\$5.4 million, the lowest since January. The decline was ascribed to reduced buying by trading firms to "cool off" the oversupplied shrimp market. Imports from Mexico continued to decline sharply. Jan.-June imports of 19,342 tons were down more than 3,000 tons from 22,714 tons imported during the 1967 period. ("Suisan Tsushin," July 24, and "Suisancho Nippo," July 22.)

* * *

Japan (Contd.):

TANNER CRAB PRODUCTION TO REACH 7,000 TONS

The 1968 tanner crab production by fleets in the Bering Sea and North Pacific is expected to reach about 7,000 metric tons (legs only with shell). Bristol Bay king crab fleets should produce about 2,500 tons; Olyutorski fleets off Siberia 3,000 tons; and land-based vessels operating out of Wakkanai, Hokkaido, 1,500 tons.

In Bristol Bay, tanner crabs are taken incidentally by gill nets and crab pots fished by factoryship fleets led by "Keiko Maru" (7,537 gross tons) and "Dainichi Maru" (5,859 gross tons). Tanner crab production by the end of July was about 1,000 tons by the Keiko Maru fleet and 600 tons by the Dainichi Maru fleet.

The 2 factoryships are scheduled to continue operations until October. Nine crab fleets are taking large quantities of tanner crabs off Cape Olyutorski. While catch as of early August was unknown, it is estimated that the season's total production will not fall below 3,000 tons. ("Suisan Tsushin," August 3.)

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BRISTOL BAY KING-CRAB FLEETS REPORT MANY TANNER CRAB

Japanese king-crab motherships "Keiko Maru" and "Tainichi Maru" (5,859 gross tons), fishing in Bristol Bay, reported early in June heavy incidental catch of tanner crabs. These crabs severely damaged crab pots and hurt king-crab production, which was running more than 30 percent behind 1967.

Concentration on King Crabs

The abundance of tanner crabs was believed due to concentration of fishing effort in recent years on king crabs. Some Japanese feel it may be necessary to thin out tanner crabs to increase the yield of king crabs. ("Shin Suisan Shimbuu Sokuhō," June 11, & "Suisan Tsushin," June 8.)

* * *

SALMON MOTHERSHIPS RETURN WITH LOW CATCH OF REDS

The 11 salmon mothership fleets assigned to Area A, north of 45° N. latitude, in the North Pacific high-seas fishery returned to Hokkaido, the northernmost island, in late

July after about 2 months. This year's fishery was generally poor because of unusually rough seas and a higher than usual water temperature. Fleet commanders reported that red salmon catches were very low, only about 10-15 percent of the total catch. Catches of less profitable pinks were relatively high.

From the very beginning, the fleets encountered unusually stormy weather. Bad weather, particularly in the central grounds, caused wide movement of the fleet and even forced suspension of fishing for 10-13 days. Water temperature to mid-season was between 1-1.5°C higher than average, advancing the season about a week ahead of normal years.

Fish Runs Poor

On the whole, fish runs were poor. Large quantities of small-sized reds taken in July indicate that a good red salmon run might develop next year. Chums taken in northern grounds were larger in size, about 2.4 kg. (5.3 lbs.), and clearly distinguishable from those averaging about 1.8 kg. (about 4 lbs.), taken in southern grounds. ("Minato Shimbuu," Aug. 1.)

* * *

FISHING POOR OFF U. S. EAST COAST

The stern trawler "Shirane Maru" (2,528 gross tons), commissioned by the Japanese government to conduct exploratory surveys in the northwest Atlantic, was catching cod and ocean perch off Labrador in mid-July. The vessel began fishing near 40° N. latitude off New York in early June. It caught mostly butterfish. From there she moved progressively northward toward Labrador, refueling at Saint Pierre off Newfoundland. Later, she crossed the Davis Strait and fished off the west coast of Greenland, but heavy ice drift forced her back to the North American coast.

Shirane Maru is not having much success. Catches to mid-July were about 200 tons of bottomfish. According to the owners, prospects of developing commercial fishing grounds in the northwest Atlantic remain uncertain.

Other Trawlers

The commercial trawler "Akebono Maru No. 51" (1,454 gross tons), fishing off New York since mid-June, found too many small-size butterfish and departed for Las Palmas

Japan (Contd.):

in late June. Two other trawlers, "Hidehiko Maru" (2,524 gross tons), and "Kaimon Maru" (2,518 gross tons), had more success fishing off the U. S. east coast in early July. However, they were scheduled to end fishing in late July for repairs. ("Minato Shimbun," July 18; "Shin Suisan Shimbun," July 8.)

* * *

SHRIMP FISHING OFF GULANAS

On June 22, 51 Japanese shrimp vessels were fishing off the Guianas. Another 21 vessels were scheduled to join the fleet by the end of August. The 72 vessels will include 35 licensed for land-based operations out of Georgetown, Guyana; 22 based at Port of Spain, Trinidad, licensed for mothership operations, and 15 based at Paramaribo, Surinam.

Ten more Japanese firms also were interested in entering the fishery. The high market price for shrimp taken off the Guianas, low investment cost of small vessels, and relative stability of the resource are encouraging fishing firms to enter the fishery. However, the Japanese Fisheries Agency is not likely to permit further fleet expansion.

Prices and Production

Fleet production reports showed the Japanese were catching and processing 350-400 pounds of shrimp, heads off, per vessel per day. Most catches were pinks and browns of fairly large size (under 25 count heads off to the pound). Delivery prices in the latter part of June averaged around US\$1.39 a pound ex-vessel and provided sufficient profit.

Lack of Repair Facilities

One problem facing the land-based operators is the lack of minor repair facilities on land for vessels and gear. The Japanese Association for Trawl Fisheries off the North Coast of South America is investigating the possibility of setting up small repair shops at Georgetown to service the shrimp fleet. ("Shin Suisan Shimbun Sokuho," July 10.)

* * *

SURVEYS SHRIMP IN SOUTHEAST ASIA

The Marine Products Importers Association is sending an 8-man shrimp survey team to southeast Asia on October 28. The team will travel to Thailand, Malaysia, Singapore, Borneo, Sarawak, and the Philippines to study the possibility of buying shrimp for shipment to Japan.

In 1967, the Association sent a similar mission to Pakistan and India. Seventy-five percent of the trip expenses will be financed by the Government's 64.2-million-yen (US\$178,333) subsidy program. The program promotes imports of unprocessed products, such as minerals, lumber, and agriculture-fishery products from underdeveloped countries. ("Suisancho Nippo," July 30.)

* * *

NEW TRAWL USED IN BERING SEA

A new all-purpose trawl that can be set for towing at all depths has been developed by Taito Seimo Fish Net Manufacturing Co. and Taiyo Fishing Co. The gear has shield-type otter boards specially designed to provide maximum net-spreading with minimum resistance.

The Net

The net, about 100 meters (328 feet) long, permits wide opening of the mouth. It is equipped with a kite for buoyancy and has 530 600-millimeter (about 2 feet) steel bobbins for dragging rough bottoms. When a school is located, the net can be set for towing at the desired depth by adjusting the otters, kite, warp, and other connections. The new gear will be placed aboard Taiyo's stern trawler "Zuiyo Maru No. 3" (3,858 gross tons).

The Zuiyo Maru No. 3

This trawler, one of the largest and most modern in Japan, has minced-meat and fishmeal plants. It is equipped with the latest sonar gear for trawling at 5 meters (16.4 feet) to 600 meters (1,968 feet). The vessel was scheduled to depart Hokkaido for the eastern Bering Sea in early August. ("Minato Shimbun," July 25 & 31.)

* * *

Japan (Contd.):

LONG-LINERS REPORT GEAR THEFTS OFF MEXICO

Tuna long-liners fishing off Mexico have reported thefts of fishing gear. One long-liner claimed her banners, radio buoys, lamps, and 20 baskets of mainline were stolen on July 12 while she was fishing near 23° 17' N, latitude and 108° 13' W, longitude off Mazatlan. One basket equals 650-1,300 feet of long line.

In the same area, on July 10, another long-liner encountered 2 foreign purse seiners and later discovered that 28 baskets of her long line had been cut off by a sharp instrument and removed. ("Katsuo-maguro Tsushin," July 23.)

* * *

TRAWLERS LICENSED FOR NORTHWEST ATLANTIC

The Japanese Fisheries Agency licensed for one year 3 commercial trawlers for experimental operations in the Northwest Atlantic, north of 40° N. latitude, off New York. The trawlers are: "Taiyo Maru No. 65," 1,829 gross tons; "Akebono Maru No. 51," 1,454 gross tons; and "Suzuka Maru," 2,529 gross tons.

To Observe ICNAF Rules

The vessels will be required to observe mesh-size regulations of the International Convention for the Northwest Atlantic Fisheries. ("Nihon Suisan Shimbun," June 12.)

* * *

SIGNS FISHING AGREEMENT WITH INDONESIA

The Japan-Indonesia fishery negotiations to ensure safe operations for Japanese vessels inside Indonesia's 12-mile limit were finally concluded on July 20. They began Dec. 1967. The 1-year pact may be extended after consultation.

Japanese vessels will be permitted to fish within designated zones in the Banda and Seram Seas. Okinawan vessels were accorded similar privileges in a separate agreement. ("Suisan Tsushin," July 22.)

* * *

TO SEND TUNA MISSION TO ITALY

The Ministry of International Trade and Industry (MITI) planned to send a mission to Italy in September to help develop a stable frozen tuna export market. The group would confer with Italian importers and packers on problems involving Japanese tuna, study frozen-tuna market conditions in Italy, and assess effects of the entry of other tuna-producing countries into the Italian market. ("Suisancho Nippo," July 30.)



Malaysia

EXPANDED TRAWLING BOOSTS CATCH

Trawling has expanded greatly in Malaysia. Prompted by Taiwan's and Thailand's great successes in trawling, the government determined that vessels of less than 75 tons can trawl economically in Malaysian waters. Licenses are issued to vessels fishing for cooperatives. One hundred and thirty vessels over 50 tons trawl legally; several hundred smaller ones trawl without license.

A dispute has erupted between offshore fishermen who operate the trawlers and inshore fishermen who claim that resources are being depleted by illegal trawling. The government has been compelled to intercede on several occasions. It has promised to stop illegal trawling in inshore waters.

Increase Catch

Fish production in Malaya State has increased over 50% in the last 2 years: from 198,000 metric tons in 1965 to 236,000 tons in 1966, and to 301,000 tons in 1967. Of the 65,000-ton increase between 1966 and 1967, 58,000 tons were estimated to have come from trawling.

Mechanize Vessels

Encouraged by the high profits of trawling, inshore fishermen are mechanizing their vessels and moving out to sea. In 1957, there were 1,700 nonpowered fishing vessels in Malaysia; now there are only 700. Vessels with inboard engines increased to over 10,000 from 1,500 in 1957; many trawl in inshore waters. ("Fishing News International," June.)



South Korea

BERING SEA OPERATIONS

Samyang Fisheries Co.'s refrigerated carrier "Sam Su No. 201" returned to Pusan July 14 with 400 metric tons of Alaska pollock caught in the Bering Sea. Another refrigerated carrier, "Sam Su No. 301," and 6 catcher vessels continued fishing off the western Aleutians until July 20.

Catch and Prices

Samyang's total catch was 796 metric tons, mostly Alaska pollock with some flounder and cod. The company invested 112 million won (about US\$407,000) in the venture. It probably will lose money because the catch was lower than expected and market value was less than anticipated. Originally, Samyang planned to catch more than 1,000 metric tons of Pacific herring, which sells at 100,000 won per ton, about US\$365, on Korean markets. Estimated sales value of the actual catch was only 30,000 won, about \$109 per metric ton, but Samyang was hoping for a sales contract at 35,000 won per ton.

State-Owned Trawlers

The state-owned Korea Marine Industry Development Corporation (KMIDC) factory stern trawler, "Kang Hwa No. 602," ended her month-long exploratory fishing cruise in the eastern Bering Sea on July 15 and returned to Pusan. KMIDC operations were separate from Samyang operations. Kang Hwa No. 602 carried about 400 tons of Alaska pollock and some herring. (U. S. Embassy, Seoul, July 23; "Oop Shinbo," July 22.)

* * *

BUYS FISHING VESSELS FROM JAPAN

Japan will build 54 fishing vessels for South Korea under the joint Economic Development Program for March 1967-December 1968. The cost will be US\$13.4 million.

S. Korea has ordered 35 otter trawlers for fishing off Indonesia and in the East China Sea, 10 tuna long-liners for the South Pacific, 3 stern trawlers for African waters, and 6 refrigerated carriers and support vessels to service coastal fishing fleets. (U. S. Embassy, Tokyo, July 15.)

* * *



South Korean fleet consisting of a 1,000-ton mothership and six 90-foot pair trawlers anchored in Dutch Harbor, Unalaska Island, in 1967. This was the first commercial venture of the South Koreans into the eastern Bering Sea following a preliminary survey by a ship in 1966. (Photo: Zahn)



Communist China

REACTS TO JAPANESE FISHING VIOLATIONS

In June, the Mainland China Fisheries Association protested Japanese fishing in prohibited areas of the China-Japan Private Agreement on Fishing in the East China Sea. Violations occurred in May and June in the vicinity of the mouth of the Yangtze River. The protest was directed to the West Japan Trawl Fishing Association, the Japanese Signatory of the Private Agreement.

15-Day Fishing Halt

Such violations have occurred each year but have brought only mild warnings by the Chinese and apologies by the Japanese. This year, however, the Chinese demanded and obtained more drastic punishment. About 80 Japanese boats that had violated the agreement voluntarily stopped fishing for 15 days in July. ("Japan Times," July 13.)



Pakistan

FIRM BUYS 6 DANISH-BUILT TRAWLERS

Fishery Products, Ltd., is buying 6 trawlers from Danish shipyards to use in the coastal shrimp fishery. They will be about 67 feet long, displace about 80 gross tons, and carry Danish-built 240 hp, diesel motors.

All 6 vessels will sail to Pakistan in a group probably with at least one Danish skipper or fisherman aboard each. The Danes would remain with the fleet in Pakistan while Pakistani crews were being trained. (Asst. Reg. Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)



India

EXPORTS SHRIMP TO U. S.

Madras is fostering interest in the export of frozen shrimp to the U. S. and other overseas markets. Shrimp catch, 9% of Madras marine landings, has increased since 500 mechanized boats began trawling off Madras. About 10 to 15 tons of shrimp are collected daily from various coastal centers and shipped to Cochin for processing and export.

The Madras Government has opened its first freezing plant, which is capable of handling 3 tons of shrimp a day. Operated by the Indo Marine Agencies (Tamil Nad) Ltd., the plant can freeze 10,000 pounds of shrimp in 10 days. The first shipment of the frozen shrimp was exported to the U. S. on July 6.

Madras landings no longer have to be sent to the west coast, risking spoilage and incurring transportation charges. More freezing plants are to be established at Tuticorin and Mandapam. Private enterprise is being encouraged to start its own. Indo Marine Agencies alone expects to handle more than 150 tons of processed shrimp a year. (Madras Govt., July 6.)



WHAT CAUSES "TIDAL WAVES"?

"Tidal waves" are not caused by the tides, but by movement of the ocean floor. Their proper name is tsunami, a word of Japanese origin. They are also commonly called seismic sea waves.

Submarine earthquakes, landslides, or volcanic eruptions create tsunamis; a submarine disturbance may produce three or four waves with a wave length (crest to crest) greater than 3 miles, although their height over the open ocean may be only 1 foot. Speed of advance can exceed 500 miles an hour. As the waves approach shore, they are slowed and the water behind piles up to tremendously destructive heights. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

SOUTH PACIFIC

New Zealand

INCREASES FINANCIAL AID TO FISHING INDUSTRY

The New Zealand government plans to increase financial assistance to the fishing industry. The plan includes assistance for used fishing vessels, new engines for replacement, and for fishing gear and equipment. Increases in mortgage guarantees and loan limits to fishermen--and refinancing of existing loans on vessels--are included. Financial assistance to buy new and used vessels will be provided, both for individual fishermen and for wholly New Zealand-owned partnerships and corporate bodies.

Financial assistance for used vessels would be for those of 40-foot minimum length and maximum age of 15 years, with a current survey certificate, and suitable for the fishing project proposed.

For Engines and Gear

Assistance in buying new engines for replacement will be based on $66\frac{2}{3}\%$ of the cost including installation, or \$10,000, whichever is less. Financial assistance also is provided to buy fishing gear and equipment where a change of method of fishing is involved and cost is significant. Such loans will be for a maximum of three years and up to two-thirds the cost of equipment, or \$10,000, whichever is less.

Mortgage guarantee assistance for new or used vessels will increase from 20% or NZ\$10,000 to 40%, or \$40,000, whichever is less; the applicant will contribute $33\frac{1}{2}\%$ instead of the former 40%. State loan limits will increase from 50%, or \$30,000, to $66\frac{2}{3}\%$ or \$60,000, whichever is less; the applicant contribution will be $33\frac{1}{3}\%$ instead of the former 40%.

Interest rate for all loans will be 6%.

Refinancing Included

Refinancing for new or second-hand vessels will be provided if venture prospects are sound, assets are adequate, and the Minister of Finance approves.

These increases in financial aid, which should further industry expansion, conform with government's desire for full development of the industry at the earliest date. ("The Australian Fish Trades Digest," April.)

Note: NZ\$1.00 = US\$1.13.



American Samoa

TUNA LANDINGS LEVELING OFF

The Japan External Trade Organization (JETRO) reports that total tuna landings at Samoa between January and April this year were 10,435 tons, or about 20% below the 12,772 tons for the 1967 period.

Landings by Japanese vessels totaled 1,718 tons, 16.5% of the total; landings for the 1967 period were 2,756 tons. The Japanese share for Jan.-Dec. 1967 was 24.4 percent.

South Korea and Taiwan

South Korean landings also declined; 3,671 tons for Jan.-Apr., against 5,112 tons for the 1967 period. However, South Korea's share was 35.2%--an increase over the average 34.6% for Jan.-Dec. 1967.

Landings by Taiwan, which have increased every year, leveled off at 4,480 tons in this period; in the 1967 period, 4,304 tons were landed. Taiwan's share has increased markedly--to 42.9% from the average 36.6% for all of 1967.

Fishing Improves

Fishing grounds around Samoa were extremely poor in February and March, but the catch recovered later to 1.5 tons per vessel per day. ("Suisan Tsushin," July 3.)



Australia

TASMANIA ABALONE CULTURE

Tasmania's abalone fishery has grown so much in the past few years that it now ranks second as a money earner to the long-established spiny lobster fishery.

Australian (Contd.):

The Fisheries Division is cooperating with 2 fish-processing firms in carrying out preliminary tests to determine the feasibility of abalone culture. The tests should help determine whether the culture of abalone is feasible--or whether juvenile abalone could be raised in farms or hatcheries to "seed" areas already fished. The program also should open other lines of research to help conserve the valuable industry.

How Abalone Are Kept

Abalone are kept in tanks so their growth and behavior can be studied in detail. At the Dunalley Factory of Planet Fisheries Pty. Ltd., sea water for the captive abalone is first drawn into a 110-gallon polyethylene header tank by an electrically driven centrifugal pump. The water level is controlled by a

float switch acting on the pump and by a foot valve on the intake pipe.

To provide the abalone with home sites other than the walls of the tanks, empty abalone shells and well-washed concrete masonry blocks were placed in the water. Within a short period, all the animals took positions away from the light. A few moved under the empty abalone shells, but the most popular locations were the shaded surfaces of the concrete blocks.

Fed on Algae

The abalone are fed on algae collected from shells in commercial abalone catches. After observation, 2 species of algae will be selected and tested as the first step in determining the most suitable food. ("The Australian Fish Trades Digest," April.)



Tahitian fishermen unloading small yellowfin and hanging them on a shoulder-pole for transportation to the market.



"Fisheries Biology: A Study in Population Dynamics," by D. H. Cushing, Univ. of Wisc. Press, 1968, 216 pp., illus., \$7.50. As the demand for food grows with the rapidly increasing world population, the measurement of the quality and extent of the world's fisheries becomes more important. Dr. Cushing describes methods by which fish stocks may be measured, conserved, and properly exploited. He stresses quantitative methods of measurement and application of mathematical concepts to fishery biology. He examines in detail methods of determining average age of different stocks, and the relationships of migrations and ocean boundaries to each other, and to the biology of fisheries.

"The Biology of Estuarine Animals," by J. Green, Univ. of Wash. Press, 1968, 401 pp., illus., \$9.50. The configuration of land and water at the meeting of a river and the sea was once crucial in the evolution of man, and is still the habitat of countless animal species. Mr. Green investigates the physico-chemical characteristics of a brackish sea environment, the vegetation that provides food and shelter, and the ways in which estuarine animals cope with their surroundings.

"Fishing with Electricity: Its Applications to Biology and Management," Fishing News (Books) Ltd., London, 1968, 304 pp., illus., £3 12s. 6d. The book contains the two-part proceedings of a symposium sponsored by the Food and Agriculture Organization in 1966. It offers the conclusions of an internationally integrated study on the application of electricity to inland fishery biology and management. The first part, a report on recent basic research on the electrophysiology of fish, summarizes present knowledge of electric fishing methods and gear. The second part, 14 papers studied by the symposium, is divided into sections covering the electrophysiology of fish, electric fishing practice, electric screens and guides, the electronarcosis of fish for handling, and an annotated bibliography of Soviet literature on electric fishing.

"The Farming of Fish," by C. F. Hickling, Pergamon Press, New York, 1968, 88 pp., illus., \$3.50. Fish farming, a practical application of limnology and freshwater biology to food production, is exciting much interest in parts of the world where it has not been common practice. Drawing on his own experience, C. F. Hickling, former Fisheries Adviser to the Colonial Office, has written a concise and informative text on fishpond management. It includes short discussions of the basic elements of fish farming, water quality and supply, pond soil, fish pond biology, stocking and species, and fish farming in the sea.

"Ocean Engineering," edited by J. F. Braatz, John Wiley & Sons, New York, 1968, 720 pp., illus., \$17.95. Believing that an engineering systems approach is required to manage the complex marine environment, the editor and 16 contributors have tried to relate social, economic, and military needs to common technological goals. The environmental aspects and technological goals of marine development are dealt with in chapters on general features of the ocean, hydrodynamics, biology, law, economics, social and military needs, and systems development planning. Other chapters cover on-site technology of deep ocean installations, fixed and mobile structures, marine vehicles, instrumentation, manned operations and work systems, materials selection, testing, and environmental simulations. This book will interest planners concerned with engineering technology applied to the marine environment. Technical managers will find particularly useful the treatment of opportunities for matching social, economic, political, and military needs with existing and potential technology.

"Marine Fishes of New Zealand," by Jim Moreland, illustrated by Eric Heath, A. H. & A. W. Reed, Wellington, 1968, 56 pp., illus., \$2.25. This simple reference book for the fisherman or amateur ichthyologist identifies,

and illustrates in color, every fish likely to be taken in New Zealand waters. The common, Maori, and scientific names, salient characteristics, diet, habitats, and methods of catching are given for each species.

"A Preliminary Review of Alternative Federal Measures of Encouraging Private Investment Enterprise in Marine Resource Development," by Miller B. Spangler, Clearinghouse, Springfield, Va., 22151, 1968, \$3.00. The demands of a rapidly growing population for oil, chemicals, metals, energy, and fresh-water leave no doubt that marine resources will have to be developed sooner or later. At present, conventional technology for farming, drilling, and mining land areas is so developed that exploitation of the oceans is not commercially competitive. Oceanics is a field in which the public interest may require new kinds of government-business cooperation. This National Planning Association report reviews more than 50 Federal measures that might stimulate private investment to develop marine resources.

Surveys of the marine science activities of 99 nations have been published by the National Council on Marine Resources and Engineering Development. The surveys describe the economic importance of marine activities to each country, the nature and scope of marine research, and the mechanisms for coordinating ocean endeavors. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, "Marine Science Activities of the Nations of the Near East and South Asia" is 30 cents, "East Asia," "Latin America," and "Africa" are 35 cents each, and "Canada and Europe" is 55 cents.

"An Oceanographic Curriculum for High Schools," by Robert Taber, Leon LaPorte, and Ellsworth Smith, 1968, 30 pp., 35¢, Superintendent of Documents, GPO, Washington, D. C. 20402. Prepared by scientists of the National Oceanographic Data Center, the booklet briefly outlines a flexible program of 18 lectures covering various areas of oceanography. Some subjects are "Man and the Sea," "Food from the Sea," "Air-Sea Interaction," "The Continental Shelf," "Limnology," "Conservation," and "Origin of the Oceans."

"Wire Angle Tables," adapted by John E. Rothrock, Cornell Maritime Press, 1968, 104 pp., \$5.00. These tables, adapted from Bow-

ditch, Table No. 3, should be a great help to oceanographers, marine biologists, fishermen and navigators. By providing instant solutions as the angle changes, they eliminate lengthy computations. They also offer an accurate method of estimating how much wire to pay out to reach a given depth for fishing or trawling, and for checking the accuracy of mechanical accumulators and tension meters.

"Mechanized Haul Seine for Use in Farm Ponds," by Kenneth L. Coon, Alfred Larsen, and James E. Ellis, FIR Reprint 57, Fish and Wildlife Service, Dept. of the Interior, 1968, pp. 91-108, illus. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. Present methods of harvesting fish from farm ponds are time consuming, laborious, and wasteful. The mechanized haul seine makes it possible to harvest fish from large undrained ponds, keeps fish ready for short-notice market requirements, maintains high quality even for live transfer, and cuts operating costs. This paper describes the design and operation of a mechanized haul seine and conveyor system developed to capture, load, and weigh fish into trucks for shipment. The seine works well in ponds ranging from 4 to 50 acres, and in water as deep as 8 feet.

"Operation of North Atlantic Type Otter Trawl Gear," FL-445, by Boris O. Knake, 15 pp., illus. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. Rigging, crew stations, and step-by-step operating instructions are fully illustrated and simply explained.

"Effect of Special Handling of Haddock on the Postirradiation Shelf Life of Haddock Fillets," by Vincent G. Ampola and Louis J. Ron-sivalli, FIR Preprint No. 58, Fish and Wildlife Service, Dept. of the Interior, 1968, 3 pp. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. The shelf life of haddock fillets can be doubled or tripled by proper irradiation. This is a report on special handling used to prolong shelf life, and tests used to determine quality of irradiated haddock fillets.

"Observations on the Physiological Ecology of Marine Fungi," a lecture by Samuel P. Meyers, Contribution No. 878, Institute of Marine Sciences, Univ. of Miami, pp. 207-225, illus. (reprinted from Bulletin of Misaki

Marine Biological Institute, Kyoto Univ., no. 12, Feb. 1968). Mycological aspects of marine microbiology are of considerable interest to scientists concerned with microbial transformation of complex substances in the sea. Dr. Meyers comments on the experimental aspects of Ascomycetes and Deuteromycetes, many of which attack wood, developed in the laboratories of the Institute of Marine Sciences over the past ten years.

"Ecology and Growth of Juvenile Tarpon, *Megalops atlanticus*, in a Georgia Salt Marsh," by William L. Rickards, Contribution No. 869, Institute of Marine Sciences, Univ. of Miami, 1968, pp. 220-239, illus. (reprinted from "Bull. Mar. Sci." vol. 18, no. 1, Mar. 1968). The tarpon Valenciennes undergoes metamorphosis from a leptocephalus larva to a juvenile much the same as the eel *Anguilla rostrata*. After reaching the shore, or shortly after moving into salt-marsh drainages, the larvae metamorphose. The next period of their lives is spent in marsh pools and creeks. This study was made to determine some of the relationships between the young tarpon and the biotic and abiotic environmental factors during this period.

"Studies of Phytoplankton Ecology in Tropical and Subtropical Environments of the Atlantic Ocean. Part 2. Quantitative Studies of Phytoplankton Distribution in the Straits of Florida and Its Relation to Physical Factors," by Gabriel Vargo, Contribution No. 866, Institute of Marine Sciences, Univ. of Miami, pp. 5-60, illus. (reprinted from "Bull. Mar. Sci.," vol. 18, no. 1, Mar. 1968). Until 1957, the majority of phytoplankton studies along the eastern coast of the U. S. were limited to northern waters. This is a quantitative study of the phytoplankton in the Straits of Florida and the effects of physical parameters upon its vertical and seasonal distribution.

"The Complete Larval Development of the West Indian Hermit Crab *Petrochirus diogenes* (L.) Decapoda, Diogenidae) Reared in the Laboratory," by Anthony J. Provenzano, Jr., Contribution No. 867, Institute of Marine Sciences, Univ. of Miami, pp. 143-181, illus. (reprinted from "Bull. Mar. Sci.," vol. 18,

no. 1, Mar. 1968). More information concerning the development of hermit crabs has been gathered during the last decade than in all the preceding years. This account of the complete zoeal development and the glaucothoë of *Petrochirus diogenes* summarizes the morphological features of the zoeae and glaucothoës as presently known, and offers some limited ecological data derived from the rearing experiments.

"The Atlantic Coast Surf Clam - with a partial bibliography," by Robert M. Yancey and Walter R. Welch, Fish and Wildlife Service, Dept. of the Interior, Cir. 288, 1968, 14 pp., illus. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. The surf clam supports an important commercial fishery along the Middle Atlantic coasts. This pamphlet summarizes the fishery's history, biology, commercial handling, processing, and marketing.

"Shell Opening by Crabs of the Genus *Calappa*," by John B. Shoup, article, "Science," May 24, 1968, vol. 160, no. 3830, pp. 887-89, illus. Decapod crustaceans of various groups open mollusk shells to feed on the soft parts. The most refined shell opening mechanism yet discovered has been found in oxystomatous crabs of the subfamily Calappinae. The article is illustrated with some remarkable photographs.

"Pontellid Copepods as Indicators of an Oceanic Incursion Over Georges Bank," by Kenneth Sherman and Everett Schaner, "Ecology," Spring 1968, vol. 49, no. 3 pp. 582-84 illus. Warm surface water has been observed at various times over the southern part of Georges Bank. Previous studies have shown that pontellids are abundant in the surface waters, and that several species are limited to discrete types of water. To supplement physical oceanographic data on the movements of the warm waters, and to delineate the region of faunal change between coastal and oceanic waters, the authors have examined the distribution of pontellid copepods collected during one of these incursions.

--Barbara Lundy



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Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.



UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES



Catfish Farming



A Growing Industry

A developing and potentially profitable segment of the fishing industry is the commercial rearing of catfish. During the past two years, thousands of new acres have been developed for production of channel, blue, and white catfish. The Department of the Interior's Bureau of Commercial Fisheries is cooperating with the catfish farming industry in an attempt to help the industry realize its full potential.

One of the Bureau's primary objectives is to improve and modernize harvesting. Research has led to development of a mechanized haul seine to harvest catfish effectively. This process enables the fish farmer to remove several thousand pounds of marketable catfish from ponds in a short time and at low cost.

The Bureau is offering technical assistance to those interested in establishing modern processing facilities. At present, the Bureau is providing information on improving layout and sanitation in five new processing plants.

The Bureau is also cooperating in conducting studies which will help the industry to define market for farm-raised catfish.

COMMERCIAL FISHERIES *Review*

VOL. 30, NO. 11

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4463X
fishes

COVER: A fisherman on the large island of Malagasy,
off Africa's southeast coast, returns to his village
with a pirogue full of small fish. (FAO/P. Pittet)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.



FISHERMEN'S MEMORIAL--GLOUCESTER, MASS.

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The Bureau of Sport Fisheries and Wildlife
make up The Fish and Wildlife Service of
The United States Department of the Interior.

Throughout this book, the initials BCF stand
for the Bureau of Commercial Fisheries.

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A day nursery school in Rangoon, Burma, where an experimental meal including fish flour was served each day.
In foreground, Mary Ross of U. S., an FAO nutritionist. (FAO/S. Bunnag)

U. S. AWARDS CONTRACT FOR FISH PROTEIN CONCENTRATE PLANT

The U. S. Department of the Interior awarded a contract on October 21 for a large-scale, pilot-demonstration plant in Washington State to produce fish protein concentrate (FPC).

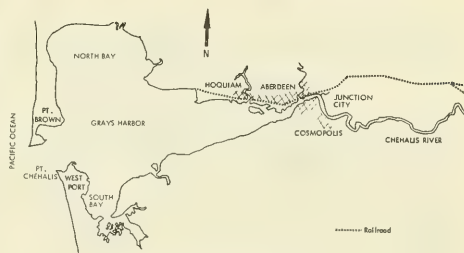
The plant will use the solvent-extraction process developed by BCF scientists. The BCF product, made from whole Atlantic red hake, a codlike fish, looks like a light-tan flour and is nearly odorless and tasteless. It is more than 80 percent animal protein and has nutritional minerals. About 6 pounds of fish are needed to produce 1 pound of FPC.

Experts concerned with the world's population explosion and the desperate need to find new food sources believe FPC can become a lifeline to a better tomorrow for hungry millions throughout the world. Today, about 2 billion of the more than 3 billion people on earth, including 50-70 percent of preschool children, suffer from protein malnutrition.

Contract Winner

Ocean Harvesters, Inc., of Los Angeles, Calif., was selected to build and operate the plant at Port of Grays Harbor, Aberdeen, Wash. The plant will not produce FPC on a commercial basis. It will show the practicability of the BCF solvent-extraction process and accumulate information on the technical and economic aspects of production to aid private industry in building plants for commercial production.

The plant will begin to operate during the 1970 fishing season. Hake and hakelike species are plentiful near Grays Harbor. Other species also can be used.



Port of Grays Harbor. (U. of Wash. Press)

BCF Process

BCF scientists at the College Park, Md., laboratory and at a model-scale plant in Beltsville, Md., near Washington, D. C., worked 3 years to develop the present process for making FPC. One breakthrough was achieved with the discovery that isopropyl alcohol would satisfactorily extract oil and water from the fish. It was an indispensable step toward making a stable and palatable product from an inexpensive fish.

The scientists found that FPC blends well with other foods. It was tested successfully as an ingredient in soups, beverages, noodles, bread, gravy, and cookies. The addition of FPC increased their nutritive value appreciably.

FPC Approved by Scientific Groups

The National Academy of Sciences advised Interior Secretary Udall that "fish protein concentrate, from whole hake, as prepared by the Bureau's process, is safe, nutritious, wholesome, and fit for human consumption." The Food and Drug Administration approved it.

UNITED STATES

U. S. Consumer Tied to Foreign Fisherman by Strong Line

One of the many stories etched by the statistics and text in BCF's "Fisheries of the United States--1967" would surprise one of the publication's main characters--the U. S. Consumer. Though he eats only an average of 10 to 11 pounds of seafood a year, his annual bill at the grocery store runs over \$2.6 billion. And he eats more imported fishery products than he would guess: \$1.2 billion of the \$2.6 billion.

In 1967, the supply of all fishery products in the U. S., on a live-weight basis, was 14.2 billion pounds; 71% of this was imported. (For 1968, the estimates are 17.5 billion

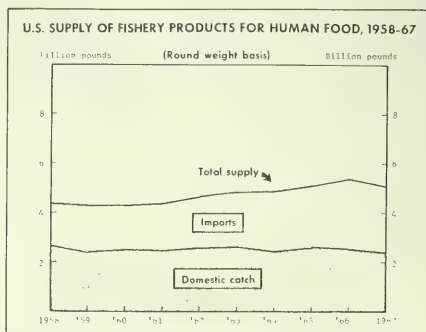
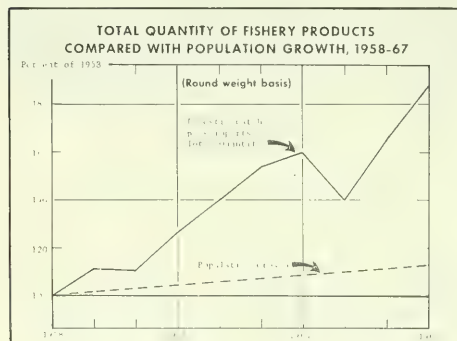
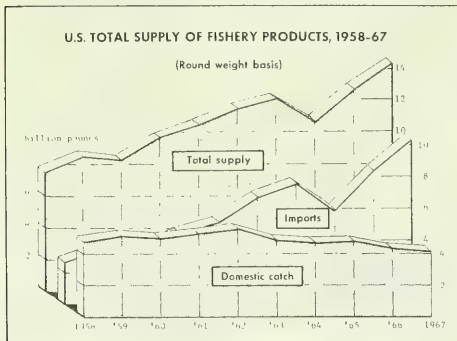
pounds--75% imported.) Of the 14.2 billion pounds in 1967, a little more than 9 billion pounds (live weight) were used for industrial purposes--for animal feed, fish feed pellets, Irish moss extracts, etc. About 82% of the 9 billion was imported.

Fish meal and scraps are the most important industrial products. These are protein feeds for animals. About 75% of the fish meal used in the U. S. is imported. So agriculture too--in the production of meat and other animal products--depends to a significant degree on foreign fishing industries.

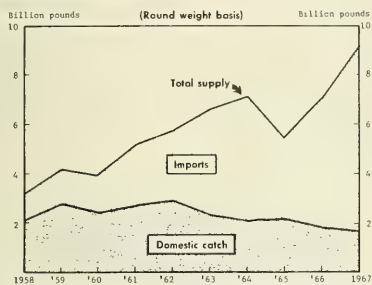
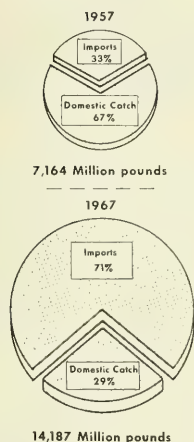
EDIBLE SEAFOOD

In 1967, the total U. S. supply of edible seafoods was 5.1 billion pounds, live weight. About 53% of this was imported. (In 1968, the figures are 5.5 and 40%.) The imports included frozen fillets, steaks and blocks; frozen tuna for canning; canned tuna, sardines, lobster, crab, and oysters; frozen lobster meat, lobster tails, and packaged frozen scallops.

However, most imported fishery products are fresh or frozen in bulk or wholesale packages. Then U. S. processors further process these items and market them under labels the U. S. consumer knows. Most important of these products are frozen fish sticks, fish portions (used in fish sandwiches) fish steaks, fillets, scallops, shrimp, and canned tuna.



U.S. SUPPLY OF FISHERY PRODUCTS FOR INDUSTRIAL USE, 1958-67

DOMESTIC SUPPLY OF FISHERY PRODUCTS INCREASED
98 PERCENT SINCE 1957

Note:--Live weight basis.

Fish sticks have become popular in U. S. households. They are made mostly from frozen blocks of groundfish fillets. In 1967, 80% of the U. S. supply of groundfish and ocean perch fillets was imported. The U. S. turned out 158.4 million pounds of frozen fish portions, 73.9 million pounds of frozen fish sticks, and 82 million pounds of fresh and frozen fillets and fish steaks. This was a total of 314.3 million pounds. In 1967, 189.5 million pounds of frozen slabs and blocks and

94.1 million pounds of fillets were imported-- a total of 283.6 million pounds.

Tuna and Shrimp

Of the canned tuna sold in the U. S., 45% was processed domestically from imported fresh and frozen tuna; 14% was imported in the can.

Over half the shrimp eaten in the U. S. was imported; 202.7 million pounds of the 394.7 million pounds consumed.

Leading Exporters

The largest exporters of edible seafood to the U. S. are Canada, Japan, and Mexico. Canada supplies most frozen fillet blocks to make fish sticks, portions, steaks, and fillets. Mexico is the number one supplier of frozen shrimp. Japan is the source of most imported tuna. Often, it is less expensive for U. S. processors to import these items than to buy them at home; sometimes, availability of domestic products is the deciding factor.



10 U. S. Firms Participate in Munich Food Fair

Ten U. S. fish-processing firms displayed their products at the International Food Fair in Munich, West Germany, Sept. 21-29. BCF's Office of International Trade Promotion, which fosters and coordinates U. S. participation in such fairs, reported excellent prospects for sales in several European nations.

Some Firsts

Several items were shown in Europe for the first time and attracted both trade visitors and public. These included Maine sardines in a flip-top aluminum container; eels, considered a prime delicacy; and 2 forms of fish chowder.

Other products displayed and provided were: canned river herring and roe, canned Gulf and Alaska shrimp, frozen Maine shrimp, individually-quick-frozen (IQF) jumbo shrimp, IQF oysters, and breaded scallops.



Albacore Fishery Is Productive Off Northwest

For the third year in a row, the albacore fishery off the west coast was centered in the Northwest. Fishing there set a record. There was little commercial activity off California.

Up to September 21, Oregon landings were 17,200 tons. This was 45% more than a year earlier--and more than the total 1967 Northwest catch of 16,000 tons. If the weather continued good, it was predicted that 1968 Northwest landings could reach 20,000 tons.

California Catch Poor

California's albacore catch was even lower than last season's catch and the poorest since 1941. Up to September 21, landings were about 3,000 tons. Last season's catch was only 6,800 tons.

Despite California's poor catch, total Pacific coast production may reach or top 23,000 tons. This would put 1968 well above the average--despite major geographic dislocations in where albacore were found.

Prices Up

Exvessel prices were above last year's: in California, \$425 per ton; in the Northwest, \$425 for cannery fish and \$400 for fish in the freezer.



50,000 Miles of U. S. Streams and Rivers Are Cleaner

U. S. grants to cities and towns to combat water pollution have helped to clean up more than 50,000 miles of streams and rivers in the last 8 years, Secretary of the Interior Stewart L. Udall has reported. He said Federal aid to construct waste-treatment plants now totals over \$1 billion and has enabled communities to build \$4.4 billion worth of waste-treatment facilities.

Udall said: "The Federal construction grant program has meant cleaner water in more than 50,000 miles of America's streams and rivers. This achievement is a classic ex-

ample of a productive Federal, State, and local community partnership. We are all pulling together toward one goal: Clean water."

He summarized Federal water pollution control enforcement activities. Since 1960, 33 enforcement actions have been held by the U. S., in cooperation with the States, involving nearly 1,000 cities and 1,100 industries.

Report Highlights

Udall also reported these highlights:

- The Water Quality Act of 1965 and the Clean Water Restoration Act of 1966 are stimulating the national water cleanup program. The 1965 Act established State water quality standards. The 1966 Act expanded greatly U. S. financial commitment to controlling water pollution.

- Water quality standards--the first nationwide effort to prevent pollution--are operating. Secretary Udall has approved the standards of 41 States, 2 territories, and the District of Columbia.

- Since 1962, the U. S. has awarded more than 3,000 pollution-control research contracts and grants. This \$100 million program to develop cheaper and more effective methods of waste treatment is moving laboratory results directly to the waterfront.

- The first regional-basin approach to water pollution control has been adopted. It includes Snake River, Colorado River, Potomac River, Delaware River, and the Lake Erie basin.

- The program to fight Lake Erie pollution resulted from enforcement conferences. The Lake Erie Report urges immediate start on spending \$1.1 billion to control municipal pollution, and \$285 million to curb industrial contamination. (See page 5.)

- Enforcement actions on Lake Michigan and the Boston Harbor area resulted in agreements to stop pollution. The 4 States bordering Lake Michigan, and the cities and industries involved, agreed on a strict schedule to build pollution-control devices. The Boston Harbor agreement will help to restore the million-dollar shellfish industry to New England.

- Fishermen are back at the North Platte River, which once was nearly suffocated by its own pollution.

- In Colorado and New Mexico, strong enforcement of Federal law removed radioactivity from the Animas River.

- This summer, people swam again for the first time in years at a once-polluted Cleveland beach on Lake Erie. A \$325,000 Federal grant plus local money made it possible.

- Federal agencies are cooperating to eliminate pollution caused by Federal activities. Interior Department's Federal Water Pollution Control Administration "has helped develop water pollution control programs at military bases, hospitals, national parks and forests and post offices."

- The U. S. and the States have expanded programs to produce trained personnel needed in the pollution-control campaign.



Plan to Save Lake Erie

A comprehensive report by the Department of the Interior's Federal Water Pollution Control Administration (FWPCA) on badly polluted Lake Erie calls for action that must be taken to prevent the possibility of "a biological cataclysm" in this lake. The plan urges an immediate start on spending \$1.1 billion to control municipal pollution, and \$285 million to curb industrial contamination. This would be enough money to curb pollution from cities and industries through 1990. It would begin to reverse the degradation trend in the lake. However, more money would be necessary later to control wastes washed into the lake from farm lands, overflows from combined sewers and, after 1990, to compensate for population increase.

Owe It to Posterity

Secretary of the Interior Stewart L. Udall said that "while Lake Erie is seriously polluted, this report has found that it can be rescued. We owe it to posterity to make an all-out effort to save this most seriously polluted of the Great Lakes while there is still time.

"Rising pollution of the Great Lakes, the largest treasury of fresh water on earth, is the natural resource tragedy of our time and could, unless checked, eventually destroy these magnificent inland seas. This looming potential disaster has only recently attracted national attention because pollution is a patient assassin which chokes its victims ever so slowly and silently."

Udall said vigorous action already is being taken by Interior Department, the States, and local governments to stop the rising tide of pollution in these lakes. But these efforts will never succeed without public support.

FWPCA Head Hopeful

FWPCA Commissioner Joe G. Moore Jr., in his introduction to the report, acknowledges that "man is destroying Lake Erie." He points out, however, that of the Great Lakes, Erie is "the most amenable to corrective measures because of its relatively small volume, rapid flushout time and the high volume of input of excellent quality Lake Huron water."

He adds: "The cleanup of Lake Erie is less a problem of engineering than it is a problem of diverse, inadequate, and unwieldy... governmental policies, funding, and management. The technical engineering methods of waste control are known or close at hand..."

The Problem Areas

The report identifies 298 municipal and 182 industrial polluters around the lake, the amount and types of their pollutants, control measures required, and schedules of measures needed, or being followed, to diminish pollution.

The most serious problem is the accelerated aging of the lake. This is caused by nutrients, phosphorus and nitrogen, in sewage, and some industrial wastes that act as a fertilizer to stimulate algal growths. The organic remains of this superabundant aquatic crop place a severe demand on the oxygen in the water. The demand is estimated to be 18 times greater than the oxygen depletion caused by treated sewage.

The report states that nearly one-fourth the lake becomes nearly devoid of oxygen in

its bottom waters during the summer. This situation is becoming worse. Man's activities have prematurely added an estimated 15,000 years to the natural age of the lake. But "the rate of aging... can be brought back to near the natural rate."

Even if the present trend is reversed, the report warns, the algae problem will persist for several years. This is because the nutrients already stored in bottom sediments are recycled in summer. "Therefore, it is possible that in a relatively short time the overproductivity of Lake Erie can become self-sustaining because of this ever-increasing reserve. It is also possible that if this alarming process grows, Lake Erie may face a sudden biological cataclysm that will exhaust, for all time, most of the oxygen in the greater part of the lake."

To reverse this trend, FWPCA recommends drastic reductions in discharges of phosphorus into the lake.

Only the joint management of water resources by Canada and the U. S. can achieve a cleanup of the lake, the report concludes.



States in Lake Michigan Basin Act on Pesticides

The conservation and resource agencies of Illinois, Indiana, Michigan, and Wisconsin signed an agreement during the summer to protect the Lake Michigan basin from any more pesticide pollution. Under the agreement, reports the Great Lakes Commission, the States will "inventory, monitor and tighten enforcement" over all possible sources of contamination in the lake area.

Farm & Urban Run-off

Surface run-off waters from about a third of the 4-State land area drain into Lake Michigan. The waters carry along some chemicals used to control insects on farms and in towns.

The Commission says the lake's pesticide contamination was dramatized by "recent findings that DDT was the most probable cause of the death of some 700,000 coho

salmon fry hatched from eggs taken from Lake Michigan brood stock."

Minnesota Acts

In an action related to the 4-State compact, the Minnesota Conservation Department halted, in August, the use of "hard" pesticides on all lands it controls. "Hard" pesticides are those that do not break down into harmless compounds after application.



Advisers Appointed to Aid Columbia R. Temperature Study

Interior Secretary Stewart L. Udall has appointed a Technical Advisory Committee for Biological Effects to help in the study of whether hot water discharges could harm salmon and other aquatic life in the Columbia River.

The 16-member committee will assist Interior's Federal Water Pollution Control Administration (FWPCA), BCF, and the Atomic Energy Commission in the 2-year study that started February 1968.

The advisory committee members represent States, the Federal Government, and power companies.



Interior Department's Marine Resources Programs Unified

The Department of the Interior's marine resources programs have been brought together under an Assistant Secretary for Fish and Wildlife Parks, and Marine Resources, Clarence F. Pautzke.



Dr. J. L. McHugh

He will be supported by a new Office of Marine Resources (OMR). Acting chief of OMR is Dr. J. L. McHugh, on detail from his permanent post as Deputy Director of BCF.

Office's Duties

OMR will coordinate and advance Interior's "marine resources policies, programs, plans, and legislation. It will work with other Federal agencies, state and local governments, international organizations private industries, universities, the scientific community and the public."

OMR will coordinate Interior's contributions to the marine resources data systems. It will help develop policy guidelines for "marine pollution control, estuarine studies, international research, survey and development activities, multi-use of the coastal zone and high seas."



Inflation Hits King Crab

Probably few food products have gone up as much in price as have king crab this year, reports BCF Seattle. The September wholesale price of fancy canned king crab (24/7½ oz. cans) at \$31.00 to \$31.50 per case was about 57.5% above a year earlier. In contrast, the average Bureau of Labor Statistics index for all selected fishery products for July 1968 was 22.7% less than a year earlier.

The following wholesale price quotations reflect the sharp price increase in king crab over last year.

	1968	1967	% Increase
King Crab - canned, fancy: 24/7½ oz. cased	\$31.00-\$31.50	\$19.50-\$20.50	57.5
King Crabmeat - frozen:			
5 lb. blks/lb.	2.60- 2.65	1.49- 1.53	62.5
2½ lb. blks/lb.	2.65- 2.70	1.51- 1.55	74.2
1 lb. blks/lb.	2.80- 2.85	1.53- 1.61	77.0
Dungeness Crab - canned: 24/6½ oz. case	17.00	15.50	9.7

The scarcity of king crab this year has stimulated competitive buying from fishermen to a point where September exvessel prices of 30 cents to 35 cents a pound were almost triple the 11 cents per pound price of 1967.



Loran 'All-Weather' Navigation Begins in Gulf of Mexico

On November 1, a \$2 million Coast Guard radio-electronic system went on the air making possible precise, all-weather navigation throughout the Gulf of Mexico. Three Loran (for Long Range Aid to Navigation) stations went into operation.

Rear Admiral Ross P. Bullard, Eighth Coast Guard District commander, said "the system amounts to a revolution in navigation for the Gulf of Mexico. Mariners who use it will be able to pinpoint their locations without visual reference. Whether they are out of sight of land, or if it's overcast, if the compass is broken, regardless of winds and currents . . . Loran will give them a fast and accurate position fix."

The Loran system took 17 months to construct. It places an electronic grid over the entire Gulf. By obtaining readings on 2 of the Loran "grid" lines, the user can determine his position merely by finding where the 2 lines cross on a Loran chart.

Before Loran

The Coast Guard said that before its system went into operation navigation in the Gulf was limited to one or more of these methods:

Celestial fixes: obtainable only in clear weather, accuracy limited by an individual's skill.

Dead reckoning methods: "calculated guessing at best." It is accurate only when careful attention is given to correct observation--and to such factors as currents, winds, time under way, compass readings, and depth soundings. Accuracy is limited by individual's skill.

Radar: usable for point-to-point navigation only when there is an identifiable land mass in range.

Radiobeacons: limited in range and having wide margin for error.

Depth soundings: navigating along fathom curves by depth soundings is common practice in Gulf. It is rudimentary dead reckoning that provides only remotest index of position and wastes time and fuel.

The Loran System

Loran has been used since World War II, but the new chain in the western Gulf is the first built primarily for commerce rather than defense. There are two Loran types: "A" and "C." Loran "A" is the type operated by the Coast Guard in the Gulf. It guarantees accuracy within one mile at its maximum useful range of about 800 miles.

Loran "C" is even more precise and complex. Its range and accuracy are far greater than needed in the Gulf. Its equipment also is much more costly--more than such users as commercial fishermen can afford. A good Loran receiver for type "A" is about \$2,000.

The new system incorporates two existing stations at Cape San Blas and Venice, Fla. With a third station at Biloxi, Miss., they had formed a Loran chain that provided good coverage only in the eastern Gulf. By the time their signals reached the western Gulf, they were no longer usable for position fixes.

The station at Biloxi was closed Nov. 1 when the new Grand Isle facility began transmitting. This was done to integrate the old chain and the new one to give better coverage throughout the Gulf.

How Loran Works

Loran navigation is based on measurement of time that elapses at a receiver between arrival of signals transmitted simultaneously from 2 different points. The receiver acts like an electronic stopwatch. The Coast Guard explains: "It begins counting when it receives the first signal and stops when it receives the second. The elapsed time gives one reading. A smooth curved line can be drawn through any number of points where the time elapsed between reception of the two signals is constantly the same." This line is a "line of position" or "a Loran line."

The Loran transmitting stations operate in pairs. Each pair produces the 2 signals needed to get one line of position reading. Pairs are further arranged in chains of 3 or more stations. When the chain arrangement is used, the intermediate stations operate in both adjacent pairs. In the Gulf Loran chain, there are 4 pairs of stations:

- Port Isabel and Galveston
- Galveston, the master station, and Grand Isle.

- Grand Isle and Cape San Blas
- Cape San Blas and Venice

For each pair, a straight line (the base line) can be drawn through the 2 stations. At this base line, all the Loran Lines are perpendicular, and from there they extend out over the Gulf in long sweeping curves through various arcs. For example, because the base line between Galveston and Port Isabel is at considerable angle to the base line between Grand Isle and Galveston, the Loran lines of position from the 2 pairs cross hatch the Gulf in a distorted grid pattern. The same is true of the other pairs.

How Navigator Uses It

To find out where he is, the Loran navigator gets readings from 2 pairs of stations. These readings correspond to Loran lines of position overprinted on regular nautical charts. He locates the lines on his chart and traces them to the point of intersection. That point is his location. It is then easy for him to translate this information into latitude and longitude, or relative bearings.

Commercial Fishermen Aided

The Coast Guard believes commercial fishermen in the Gulf can benefit much from Loran. Its precision navigation can mean greatly reduced running time to and from fishing grounds--saving fuel. When good fishing areas are located, they can be pinpointed for later trips or to guide other boats to the area.

Accurate position reports through Loran also will bring help faster. The Coast Guard has had to search thousands of square miles of ocean when looking for a fishing boat in distress that gave only the vaguest indication of its position. In some cases, the time consumed in such a search could mean the difference between life and death--or between loss of a valuable boat and catch and a safe return to port.

Loran charts for the Gulf and air navigation charts are available. Coast and Geodetic Survey chart No. 117 also is available. Others, as they are published, will be obtainable through authorized sales agents.



Data Center Gathers Definitive Story of the Sea

During 1967 the ocean data-gathering agencies of the U. S. Government reported the findings of over 600 cruises of their research and exploratory vessels to the National Oceanographic Data Center (NODC) in Washington, D. C. It was the first time that complete information on the total national marine-science effort became available in one place. NODC also filled a role in global oceanography: It was one of two nerve centers providing information to oceanographers everywhere. The second center is in Moscow.

NODC is sponsored by U. S. Government agencies interested in the marine environment. It is governed by an Advisory Board representing these agencies and the National Academy of Sciences. The U. S. Naval Oceanographic Office manages the Center. NODC's mission "is to acquire, process, preserve, and disseminate unclassified oceanographic data for scientific, industrial, and defense purposes."



Fig. 1 - Nomad (Navy Oceanographic Meteorological Automatic Device) buoy transmits data up to 2,000 miles over standard 100 words-per-minute radioteletype circuits. (U. S. Navy)

Reorganizes to Meet Challenge

Early in 1968, NODC reorganized its operation to cope with the great changes taking place in data gathering. Nansen bottle casts are being replaced by continuously recording salinity-temperature-depth (STD) systems that can be kept in place. The mechanical bathythermograph (BT) is giving way to the more exact XBT. More buoys are being anchored throughout the oceans. These are equipped to sense and record great amounts of data. The types and amounts of oceanographic data received from manned and unmanned satellites are increasing rapidly.

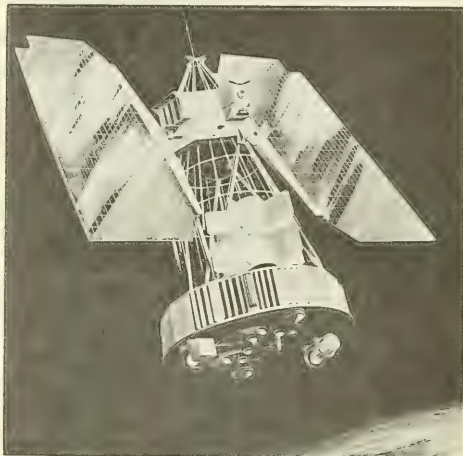


Fig. 2 - Nimbus weather satellite (NASA).

National Marine Data Inventory

NODC conducted the first National Marine Data Inventory (NAMDI) during fiscal year (FY) 1968 in order to become a central bank of information on the national effort in oceanography. It recorded the more than 600 cruises conducted by U. S. agencies. NAMDI includes information on quantity and type of data, area of operations, and persons participating. Track charts and narratives are available for many cruises. Statements on sampling and analytical techniques are included. The results are being automated.

When this task is completed, NODC will be able to answer--by use of punched card or magnetic tape sorts--such questions as: "Has



Fig. 3 - Ocean Science Important to Ice Patrol Vigilance--The constant study of the ocean currents, which greatly influence iceberg movements, is important to the Ice Patrol's predictions and tracking plots for iceberg seasons. Here, a Salinity Temperature Depth Sensor system is used on the Coast Guard oceanographic vessel "Evergreen" on a mission to determine if the source of the Labrador Current is in the Hudson Strait. The Sensor systems instantaneously record readings of salinity, temperature, and depths down to 1,500 meters. (U. S. Coast Guard)

anyone sampled euphasids in Providence Channel? Who took cores in the Indian Ocean? Where? Who has them now? Were South Pacific plankton species studied during the austral winter? What was the total number of United States research vessels operating in the Atlantic during the last fiscal year?"

World Data System

As one of the two centers of the world data system, NODC makes available to world's scientists information from a list of cruises included in a U. S. Declared National Program (DNP). Information from 366 cruises was identified as DNP.

Vast Influx of Information

A great stream of information flows into NODC. Oceanographic station data (Nansen casts) and bathythermograms continue to ex-

ceed the influx of other data types. During FY 1968, over 31,000 oceanographic stations and 110,000 BT observations were received. Biological data came at a rate of about 500 stations per month. In geology, a good start was made on sediment data from the U. S. Naval Oceanographic Office and Scripps Institution of Oceanography. Seismic reflection



Fig. 4 - Nansen bottle is attached to wire to obtain temperature, pressure, and water sample at predetermined depth.



Fig. 5 - Bathythermograph makes quick record of temperatures at different depths. Data are useful in finding fish.

data holdings increased by 32,000 miles of records--primarily for the Mediterranean, Atlantic, and Pacific.

NODC Achievement

NODC data processing of Nansen casts has compiled the most comprehensive file ever set up in oceanography. After $2\frac{1}{2}$ years of work, the Nansen cast data file of geosorted stations has been made worldwide. It consists of 54 reels of magnetic tape, each more than a half-mile long, packed in 556 characters per inch. The file has over 280,000 stations in every ocean of the world; it has over 6 million tape records. The oceanographer can find comprehensive information



Fig. 6 - Biologist using a light transparency meter to measure turbidity in the waters of Galveston Bay, Texas.

about "temperature, salinity, oxygen, phosphorus, nitrogen, and silicate data observed at specific depths."

NODC hopes to get a new computer that will increase its processing capacity at least 8 times. It will enable the Center to furnish information about "biology, geology, salinity, temperature, depth, sediment chemistry, and a host of user-oriented systems."

NODC Director

The NODC operation is headed by Dr. Thomas S. Austin, former director of BCF's Tropical Atlantic Biological Laboratory in Miami, Fla. Dr. Austin became NODC director on July 2, 1967. He serves too as Director of World Data Center A, Oceanography.



OCEANOGRAPHY

Scientists Record Whale 'Talk'

Scientists from the U. S. Naval Oceanographic Office (NOO) and the University of Rhode Island successfully recorded the sounds of 7 different species of whales and dolphins inhabiting the North Atlantic on a recent cruise off Nova Scotia, Newfoundland, and New England. The tapes now are being studied to compare the mammal 'talk' with similar sounds heard by Navy sonar men tracking submarines.

In addition, the scientists under Dr. H. E. Winn, professor of oceanography, University of Rhode Island, bounced sonar signals off the aquatic mammals to determine the strength of the resulting echoes. These echoes, reported Lt. J. Lawrence Dunn, a NOO biologist, have been known to create problems for the Navy's antisubmarine forces.

Sight 7 Species

Sailing on August 13 aboard the "Trident," an 180-foot research vessel operated by the university, "the scientific party and crew recorded sightings of several hundred whales and dolphins of seven species" from August 20 to 22, reported Lt. Dunn. The scientists successfully launched active and passive sonobuoys--sophisticated acoustical devices used to pick up mammal 'talk' and the echoes bounced off their bodies. The expendable active sonobuoys were used as sound sources for bouncing signals off the mammals. These buoys also enabled the scientists to receive acoustic data while sailing a normal course. The passive buoys were used to transmit the mammal 'talk' to the ship.

Early Success

Lt. Dunn recalled: "We encountered a pod (school) of killer whales" after the ship had barely cleared the harbor at St. Johns, Newfoundland. "The proximity of the nearby land mass made our active sonobuoy work impossible, and problems with the videotape system prevented the university personnel from carrying out planned observations on this species."

On the next day, however, the scientists spotted large numbers of pilot whales and

recorded their sounds before the Trident was forced by icebergs and the illness of a university graduate student to return to St. Johns.

On August 15, after abandoning their plan to circumnavigate Newfoundland, the scientists headed southwest to Cabot Strait. On August 16, they sighted finback whales about 60 feet long. They deployed the active sonobuoys and recorded mammal echoes despite the failure of one of the three buoys.

Rough weather hindered the hunt until August 20, when the Trident came within inches of a 55-foot sperm whale. After the scientists recorded the sound produced by this whale, and another encountered later in the day, they again saw finbacks. But the sperm whales talked so loud that they obscured the sounds of the finbacks.

"I obtained my revenge on one of the offending sperm whales by tagging him with a Fisheries Research Board of Canada whale tag," Lt. Dunn said.

After shaking off the sperm whales, the scientists recorded the sounds of 3 other species--pilot whales and bottlenose and dolphins--during August 21 and 22.



Data from 'Oceanographer' & 'Discover' Cruises Microfilmed

The Environmental Data Service, a component of the Environmental Science Services Administration (ESSA), has microfilmed most of the observed geophysical data gathered during the USC&GSS Oceanographer's 1967 Global Cruise and the USC&GSS Discoverer's 1968 African Cruise.

Copies of these preliminary data and reduced geophysical data from the USC&GSS "Pioneer's" 1964 International Indian Ocean Expedition and the Pioneer's 1965 and "Surveyor's" 1966 West Coast Upper Mantle Project are now available from the Environmental Data Service, Silver Spring, Maryland 20910.



Two C&GS Survey Ships Commissioned

Hydrographic survey sister ships of the Coast and Geodetic Survey, "Fairweather" and "Rainier," were commissioned October 2 in Seattle, Wash.

The 1,627-ton, 231-ft. vessels, equipped with the latest electronic, depth recording, and positioning equipment, will chart U. S. coastal waters to help provide safe navigation for commercial shipping and recreational boating. They will operate in Alaskan and West Coast waters.



Vast Undersea Valley Shown Off Oregon

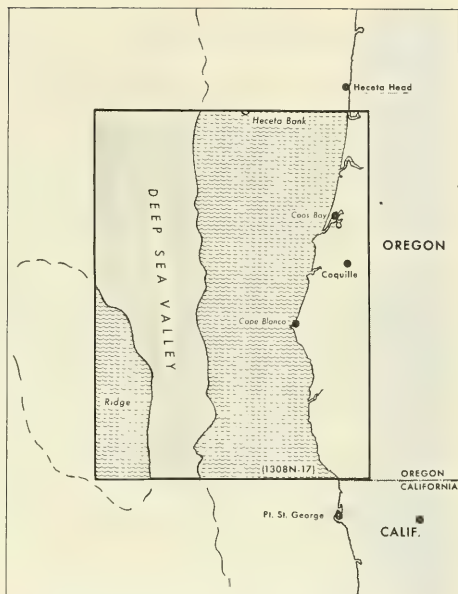
A new map of the ocean floor published by the Coast and Geodetic Survey shows a vast undersea valley off the Pacific Coast. The valley extends about 400 miles along Oregon and California. Approximately 35 to 60 miles from the coast, about one to two miles below the sea surface, the valley is 15 to 60 miles wide.

About 140 miles of the valley appear on the new bathymetric map. The map covers approximately 13,000 square statute miles of sea bottom. It extends 65 to 95 miles seaward off the south Oregon coast, from Cape Ferrello to the Umpqua River. Depths range from a few feet off the coast to over 10,500 feet about 40 miles west of Cape Sebastain.

Noteworthy Features

The other noteworthy features on the new map include part of an extensive ridge west of the valley rising over 3,100 feet from the bottom, and the southern tip of Heceta Bank, 35 miles west of Florence, which rises to within 167 feet of the water's surface.

The bathymetric map provides the most detailed bottom topography of the area published. It is one of a series planned by CGS for the seabeds off the Atlantic, Pacific, Alaskan, and Gulf coasts.



Area covered by bathymetric map (1308 N -17) of sea bottom off south Oregon, including vast undersea valley.

Maps Aid Development

The maps are designed to aid Federal, state, and industrial interests explore and develop the potential resources of the continental shelf. It is an area of approximately 862,000 square statute miles off the U. S. coasts. Economic development of these resources depends heavily on bottom topographic maps; few exist. Knowledge of the seabottom is essential for marine engineering, scientific studies in recovering offshore oil and minerals, and to evaluate shoreline erosion and accretion.

Previous maps include the shelf off northern Oregon, southern California, the Aleutian Islands, northeastern Gulf of Maine, and the mid-Atlantic coast (from Cape Cod, Mass., to Chincoteague Bay, Md.).



Revised 'Mariner's Bible' for Pacific Coast Published

The 10th edition of U. S. Coast Pilot 7, the "mariner's bible" for the Pacific Coast and the first in 5 years, was published this month by the Coast and Geodetic Survey (CGS). The 380-page volume contains the latest information on the coast and harbors of California, Oregon, Washington, and Hawaii. The agency spent a year conducting an on-the-spot inspection.

The book has served mariners for more than a century. It includes greatly expanded information on port facilities at some of the most important U. S. Pacific harbors, including San Diego, Los Angeles, Long Beach, San Francisco, Portland, Seattle, Tacoma, and Honolulu.

There is detailed information on wharves, cargo-handling equipment, depths alongside wharves, available storage area, etc. Small craft information has been increased. The emphasis is on the transient boatman away from his usual cruising area.

8 Coast Pilots

CGS publishes eight coast Pilots covering all U. S. coastal and intercoastal waters. New editions appear about every 5 years.

Generally, the book furnishes information that cannot be shown graphically on marine charts, such as navigation regulations, outstanding landmarks, channel and anchorage peculiarities, dangers, weather, ice, freshets, routes, pilotage, and port facilities. Cumulative supplements, containing changes, are published early each year.

Coast Pilot 7 describes the numerous bays, harbors, and rivers along the coasts of California, Oregon, and Washington. It also describes the offshore Channel Islands of southern California, the Sacramento and San Joaquin Rivers and their delta region, the Columbia River, and the large "inland sea" comprised of the Straits of Juan de Fuca and Georgia, and Puget Sound. A chapter on Hawaii describes the 8 larger islands and many small outer islands of the Archipelago.

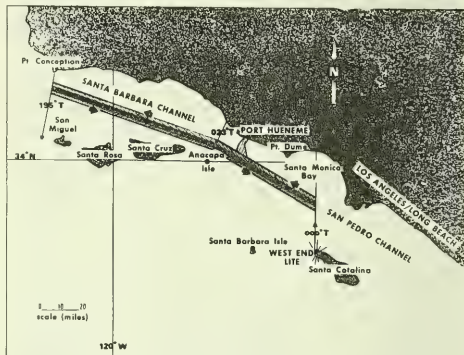
The new edition costs \$2.50. Available from the Coast and Geodetic Survey (C44),

Rockville, Md. 20852, or from CGS sales agents. Annual supplements are distributed free.



Coast Guard to Set up Sealanes in Southern California

The U. S. Coast Guard has established coastwise sealanes in Southern California from Point Conception thru the Santa Barbara Channel to Santa Monica Bay. The new sealanes, effective Jan. 1, 1969, will provide safe passage thru areas of potential oil exploration and minimize risk of collisions. Similar plans already operate in New York, Delaware Bay, and San Francisco.



The sealane idea is similar to the divided highway of land transportation. The sealane is composed of 2 lanes, each one-mile wide, with traffic flow in opposite directions, separated by a "buffer" zone 2 miles wide. This idea has had good results on the Great Lakes since 1911. With the cooperation of domestic and foreign shipping lines, the risk of collision will be held to a minimum.

An overall plan includes a system of coastwise lanes extending from Point Conception to San Diego and linking the ports of Los Angeles/Long Beach, Port Hueneme, and San Diego.



Foreign Fishing Off U. S. in September

NORTHWEST ATLANTIC

One hundred and sixty-nine fishing and support vessels from the USSR, Poland, East and West Germany and Romania, were sighted in September, 44 fewer than in August. Such a decrease, due mostly to the departure of small Soviet side trawlers, is normal at this time.

Soviet: Soviet vessels--32 factory stern trawlers and 56 medium side trawlers--were observed fishing intensively along the 40- and 50-fathom curve, from Cultivator Shoals to the northern edge of Georges Bank, taking moderate amounts of herring and mackerel.

Polish: Polish vessels, about 35 in August, decreased to 24--9 stern trawlers and 15 large side trawlers fishing herring on the northern edge of Georges Bank. In September 1967, 38 Polish trawlers and support vessels were sighted there.

East Germany: The fleet, 31 vessels in August, decreased to 20 in September. Nineteen freezer stern trawlers and 1 factoryship were fishing herring east of Cape Cod and Nantucket, and on the northern edge of Georges Bank. In September 1967, 11 East German trawlers were sighted on Georges Bank.

West German: Fourteen freezer stern trawlers and 7 side trawlers (2 pair trawling) were observed fishing in the same general area as the East Germans. Only 4 stern trawlers were sighted in September last year.

Fishing in the Contiguous Zone

Special Coast Guard Sea and sea patrols were instituted early in the month. As exact measuring is very difficult, due to the lack of good shore line features, reports of foreign vessels fishing inside the 12-mile zone could not be confirmed.

GULF OF MEXICO, SOUTH ATLANTIC, AND CALIFORNIA

No foreign vessels were sighted in September. Reports of a Japanese long-liner fishing south of San Clemente Island were not confirmed.

PACIFIC NORTHWEST

Thirty-three Soviet vessels were sighted during September--25 large stern trawlers and 8 processing and support vessels. Light catches were observed aboard vessels fishing off Washington in the first half of the month; in the second half, when fishing had switched to off Oregon, good catches of Pacific hake were observed.

The nature of Soviet hake fishing has changed considerably this year. In 1966 and

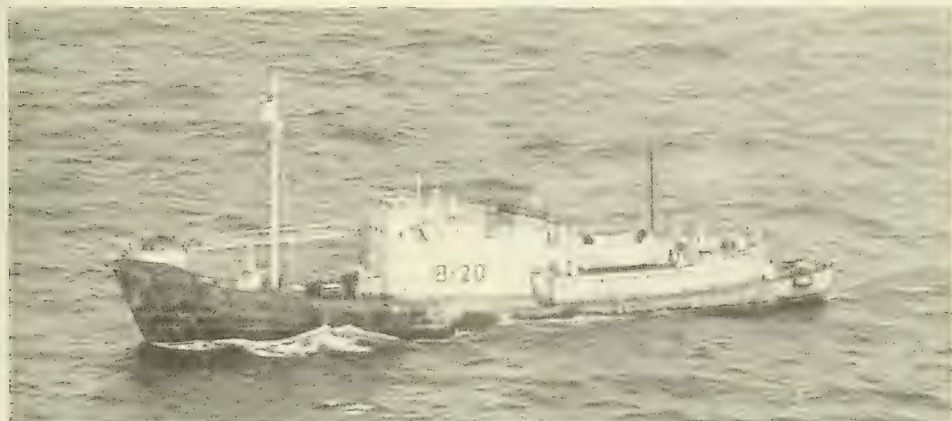


Fig. 1 - "Ryanyy," whale catcher ship. This type of vessel highly maneuverable and capable of 18-20 knots. It is 208 feet long. (BCF/Crosby)

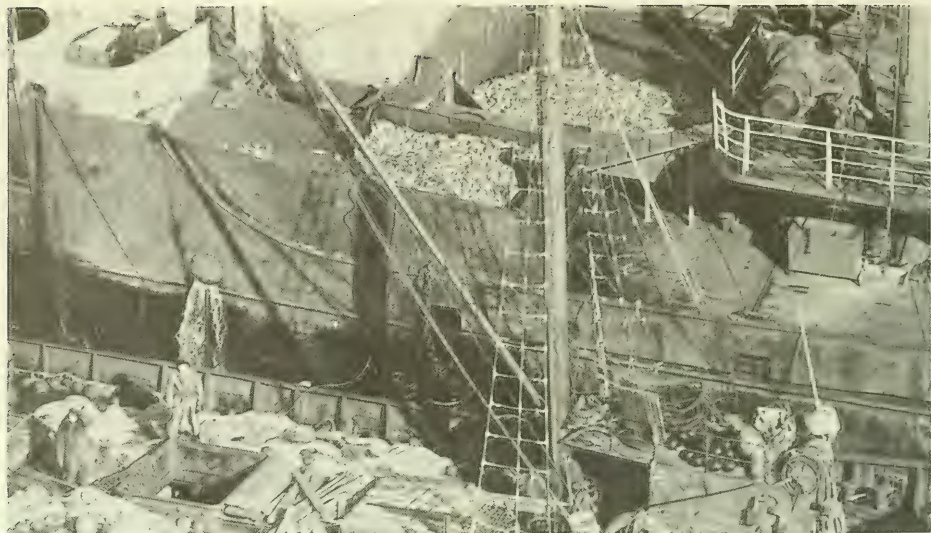


Fig. 2 - Unloading Pacific ocean perch from the "SRT Som" to the refrigerator reefer ship "Evaron." Note perch in bins aboard Evaron. (BCF/Branson)

1967, vessels were mostly medium side trawlers; this year there were more stern than side trawlers. There is evidence that experimental pair trawling with medium trawlers has not proved successful. Over 180 vessels were sighted in 1966 and 1967, compared to only 86 this year, but because of the greater efficiency of stern trawlers, the smaller number does not mean that Soviet hake catches will decrease.

ALASKA

Soviet: Soviet vessels fishing off Alaska fluctuated between 20 and 30, about half the number sighted in September last year.

Six stern trawlers along the Aleutians, and 2 in the Gulf of Alaska, fished for ocean perch. Ten medium trawlers fishing for pollock, flatfish, perch, and gray cod, along the Continental Shelf edge in the eastern and central Bering Sea, ended the fishery in mid-September. One whale catcher, sighted in central Bering Sea, is believed to have belonged to a fleet of 8 catchers and 1 factoryship.

Japanese: The 180 Japanese vessels observed during September had dropped to 130 by the end of the month because of declining

ocean perch and minced meat and meal fisheries. A drop in effort in ocean perch fisheries is typical for that time of year. At mid-month, there were 6 factoryship fleets in the minced meat and meal fishery in the eastern and central Bering Sea; one returned to Japan at month's end, while the remaining 5 factoryships and 91 trawlers, spread out on the Continental Shelf, north of the eastern Aleutians and Alaska Peninsula, to north west of the Pribilofs.

The 2 king crab factoryship fleets on the Continental Shelf, north of Port Moller, will stay on into October to take advantage of the high catches of tanner crab. One combination processing and fishing vessel, observed fishing tanner crab in the central Bering Sea in July, was sighted there again, presumably still fishing tanner crab.

The 9 vessels long-lining for sablefish in the Gulf of Alaska had decreased to only 1 or 2 by the end of the month.

Two stern trawlers fishing shrimp near Two-Headed Island, off southwest Kodiak Island, ended their operations by mid-September.

Note: During surveillance patrols, vessels are sighted, recorded, and identified as to type. Vessels are counted only once; if a vessel was sighted more than once it is counted as only one vessel, excluding duplicate sightings. Since vessels continuously arrive and depart, the total number of identified vessels for the month will always be larger than the actual size of the fishing fleets observed.

STATES

Alaska

SALMON CATCH IS 88% ABOVE 1967

BCF Juneau provides this summary of 1968 fishery developments in Alaska: The 1968 salmon catch is estimated at 260 million pounds with an exvessel value of \$37.5 million--up 88 percent in volume and 52 percent in value over 1967.

King salmon landings remained relatively stable at 11.5 million pounds worth \$3 million.

Chum salmon landings of 75 million pounds were the highest since 1944; the value of \$7.5 million set a record.

Coho salmon landings of 18.5 million pounds were the highest since 1964, and the \$4.5 million value a record.

The red salmon pack of 207,694 cases in Western Alaska was the lowest since the fishery began.

Pink salmon were large in number but small in size. They averaged 3 pounds per fish throughout Alaska.

Alaska salmon have more production and marketing opportunities because of modern transportation systems. For example: nearly 500,000 pounds of pinks were shipped from Prince William Sound to the supermarket trade, and frozen chum salmon have entered markets in Sweden and Japan.

Crab Landings

King crab landings of about 85 million pounds will be down 33 percent from 1967 landings of 127.7 million pounds. But value will set a record--up about 66 percent from \$15 million to over \$25 million.

On September 20, the Alaska Department of Fish and Game raised minimum size of king crab to 7 inches (carapace width) for all Alaska. Previously, minimum legal size had been 5½ inches for Bering Sea area, and 6½ for Aleutian Islands area.

Dungeness crab landings in 1968 will approach 12 million pounds. These are slightly higher than 1967 landings of 11.6 million

pounds, but increased exvessel prices will raise value 20 percent--from \$1.5 to \$1.8 million.

Tanner crab landings will top 3 million pounds in 1968; the 1967 catch was only 118,000 pounds.

Shrimp landings may be slightly less than in 1967. Estimates are for a year-end total of 40 million pounds, compared with 42 million pounds in 1967.

Scallop landings will hit 1.5 million pounds of meats with an exvessel value of \$1.4 million. This is the first year scallops have been landed commercially.

* * *

SHELLFISH INDUSTRIES CONSOLIDATING

Ownership and management of the Alaska shellfish industry are changing. Shellfish operators in Alaska are mostly corporations with headquarters out of the state. Most often they are financially related to brokerage or marketing firms. Some have been engaged in salmon and other fisheries of Alaska for decades.

During the past 5 years, there have been consolidations of established shellfish packers with new entrants. Foreign operators, notably the giant Japanese firms Taiyo, Mitsubishi, and Nichiro, also have entered the industry. They did this usually by joint venturing with established domestic firms. The new domestic entrants, national rather than state level, are generally parts of the larger national food processing and marketing industry.

Recent Changes

Alaska's pioneer king-crab operation, Wakefield Fisheries, was sold recently to Hunt Wesson Foods, Inc., a subsidiary of Norton Simon, Inc. General Mills acquired Point Chehalis Packers with plants at Kodiak and Cordova. Mergers of nationally active firms include Ralson-Purina and Westgate-California Foods. For longer periods, the national firms of Castel and Cooke, Vita Foods Inc., New England Fish Company, Nakat Packing Company (a subsidiary of A&P), and the

California Packing Corp. (or "Del Monte") through its subsidiary, the Alaska Packers Assoc., have been active in Alaska.

Regional Operators

Operators that are more regional in character (Pacific Northwest and Alaska) are Washington Fish and Oyster Co., Columbia-Wards, Pan-Alaska Fisheries, Ivar Wendt of Seattle ("Pacific Pearl"), Whitney-Fidalgo Seafoods, Kayler-Dahl, Petersburg Fisheries, and others.

* * *

MORE NATIVE RESIDENT ALASKANS HIRED

Alaska Commissioner of Labor Thomas J. Moore reports that "more Alaska natives worked in more jobs in more fish processing and canning plants in western Alaska in 1968 than in any other year in history." Moore attributes this sharp upsurge to a realization by cannery owners that it makes good sense to hire qualified local workers.

During the first 8 months of 1968, nearly 200 Eskimos were placed in fish processing and canning jobs in one small western community. Two years ago, only 70 Eskimos found jobs in the same community.



California

SAN PEDRO FISHERMEN'S INCOME DECLINES

From 1963 to 1967, the average annual income for fishermen in the San Pedro, Calif., fleet fell from about \$4,600 to about \$4,100. (The average family income in U. S. is \$8,900.) During 1958-1968, the fleet decreased from 63 boats with a capacity of 5,745 tons to 28 boats with a 2,470-ton capacity. All vessels were built before 1945. These preliminary data were reported by William Perrin of the Operations Research program of BCF's Fishery-Oceanography Center.

High Cost of Replacing Fleet

Perrin visited the Seattle-Tacoma (Wash.) region to get estimates of how much it would cost to replace the San Diego wetfish seiners.

He talked to representatives of 3 boatbuilding companies. While the estimated market value of the San Pedro vessels ranges from \$20,000 to \$60,000--estimates of the cost of building vessels to replace them range from \$120,000 to \$400,000, depending on size and equipment.

San Pedro is No. 1

In 1967, for the 19th consecutive year, San Pedro was the No. 1 U. S. port. Its landings were worth \$28,598,000. In 1950, it set the all-time record for landings in a single season with 848 million pounds of fishery products.

* * *

FISHING INDUSTRY DOES NOT SHARE IN THRIVING ECONOMY

California's economy has been prospering for years, but the fishing industry and fleet have not shared its success. The somber story of the industry is outlined in the 1968 report of BCF's Fishery-Oceanography Center in La Jolla, Calif. The Center is dedicated to advancing basic fishery science--and to conducting research on problems relevant to fisheries in its area in order to improve them.

Resources and Problems

In 1966, the fish industry used as raw material about 250,000 metric tons of 50 species of fish and invertebrates worth \$87 million. Of the total, 60,000 tons worth \$32 million were caught by foreign vessels and shipped to California processing plants. The imports were 22% of the total weight and 37% of the value.

By 1966, landings had declined to under a third of the 1939 figure. The tuna industry depended increasingly on foreign catches. In 1939, the California fleet's total catch was over 750,000 metric tons worth \$18 million; only 3,000 additional tons were imported.

Many Causes

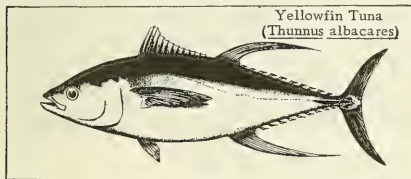
This decline "is the basis of the problem facing the California fish industry and its fishing fleet," states the La Jolla report. It continues: "Attributable to no single cause, the failure to participate in the generally rising prosperity of the California economy can be blamed on unwisely heavy fishing of

some resources, on natural changes in resource abundance due to climatic trends, and on increasing foreign competition in the tuna fisheries and in the fish meal and oil markets."

1939 vs. 1966

In both 1939 and 1966, the 5 main elements of the California fisheries were tuna, salmon, industrial fish, fresh fish, and invertebrates.

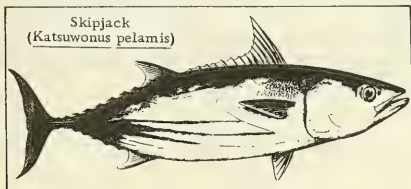
By 1966, tuna landings had increased about 33% over 1939. Yellowfin tuna (*Thunnus albacares*) dominated in 1966 as in 1939; the proportions of the other species remained about the same. In 1939, cannery imports were only 3,178 tons; by 1966, imports were 60,832 tons. These imports were 45% of the value of raw materials used by processors; in 1939, the figure was only 5%.



By the early 1960s, researchers realized that stocks of yellowfin tuna had reached their maximum sustainable harvest. In 1966, the yellowfin were brought under effective international regulation for the first time.

Underutilized Tuna Species

With yellowfin tuna landings at a peak, it became important to increase the harvest of underutilized tuna species--or imports would continue to spiral. The La Jolla report states: "Fortunately, it appears possible that the skipjack tuna (*Katsuwonus pelamis*) population and perhaps those of the temperate tunas are not fully harvested and ways of increasing the take of these species by California vessels are now being studied within the Fishery-Oceanography Center."



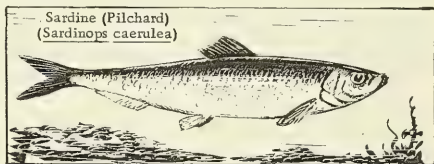
Salmon Fishery Stable

The salmon fishery off Northern California has been stable since the late 1930s. The value of landings has increased.

Industrial Fishery Troubled

The industrial fishery ("wetfish fishery") is worst off. It uses pelagic species of the California Current. These are reduced to fish meal and oil--canned as inexpensive canned products (mostly for export) and processed into animal foods. This fishery declined from great prosperity in the 1930s and 1940s to current despair. In 1939, landings topped 500,000 tons; by 1966, they had dropped to about 60,000 tons.

The decline is attributed mostly to the collapse of the northern subpopulation of the Pacific sardine (*Sardinops caerulea*). This began during the 1940s and hit bottom in the 1950s. In 1939 sardine landings were 500,000 tons--79% by weight and 34% by value of all landings; in 1966, they were only a few hundred tons.



Fresh Fish

The fishery for fresh fish is less depressed than the industrial fishery. The landings in 1966 were about the same as in 1939, but their value was higher.

Fishery for Invertebrates

The fishery for invertebrates has remained a minor one in California's total fishery economy. This is true despite the more than twofold increase in landings--due mostly to increased exploitation of squid and market crab.



Oregon

FALL CHINOOK RUN PAST WILLAMETTE FALLS SETS RECORD

A record 4,260 fall chinook conquered Willamette Falls, historic barrier to spawning salmon in the Willamette Basin, in 1968, the Oregon Fish Commission has announced.

The number passing over the cul-de-sac portion of the multimillion dollar Willamette Falls fishway, together with the old ladder, was more than double the 1967 count. Most fish used the new cul-de-sac fishway. This was reported by Roy Sams, project leader on the Columbia River Watershed Development Program.

Small But Significant Number

The number of fish, though relatively small, is significant, Sams emphasized. He noted that the fledgling upriver run has built up steadily from the period when the fall chinook faced virtually impassable conditions. Recent aerial surveys of the Willamette and its tributaries by Fish Commission and BCF biologists attest that the majority of fish getting above the falls spawned successfully.

Biologists believe that once the fishway is completed, the fall chinook run could expand eventually to over 90,000. To develop this potential, the Fish Commission and the Fish and Wildlife Service have planted millions of juvenile fall chinook in the Willamette system since 1963.

Sams said the development of a 90,000 run could be speeded greatly with money to expand the present salmon pond rearing program in the Willamette Valley.

More Ponds Proposed

The Fish Commission is pleased with the successful rearing program conducted at the Salem Cascades Gateway Park in 1968. It has proposed 4 more pond rearing sites. These and the Salem pond could produce annually 25 million fall chinook smolts. The ponds would be located on the Molalla, North Santiam, South Santiam, and on the main stem Willamette near Eugene.

How successful the pond rearing program will be depends on the return of adult fall chinook; the first are expected in 1970.



Texas

HYBRID SUNFISH EXPERIMENTS ARE SUCCESSFUL

The Texas Parks and Wildlife Department may have a solution to sunfish overpopulation in lakes and ponds: a hybrid sunfish. It is a cross between the female redear and the male green sunfish. The hybrids grow much faster than their parents and have only a fraction of their reproductive capacity.

Harmon Henderson, fish hatchery superintendent at San Marcos where the hybrid was developed, says the new sunfish is unique in physical appearance and as beautiful as its parents. The hatchery began experimenting in 1963 with the possibilities of producing a hybridized sunfish for stocking ponds.

Approaches to Problem

According to Henderson, the problem with normal sunfish is that one female may produce 12,000 to 65,000 eggs. The population explosion produces too many fish that cannot grow.

Henderson notes various methods used to control sunfish populations, including rotenone treatments of ponds and seining. Ponds with controlled water levels have been lowered sufficiently to expose sunfish nests and eggs to air in order to destroy them.

Hybrids May Be Answer

These measures are not needed with the hybrid. The hybrid are reproduced at a ratio of 4 males to 1 female. An experimental pond, drained after hybrid eggs hatched, had an average of only 300 offspring per female.

Experimental stocking of hybrids in farm ponds has been successful. Some hybrids reached 2 ponds in 2 years.



BUREAU OF COMMERCIAL FISHERIES PROGRAMS

'Delaware II' Replaces 'Delaware'

BCF Gloucester (Mass.) has a new research vessel--the Delaware II. The vessel was delivered by the builder, South Portland Engineering Co., on October 4.

The Delaware II replaces the M/V Delaware, which will be sold by the General Services Administration in November. The new vessel will conduct exploratory fishing and gear research in the Northwest Atlantic--from Maine to Virginia--and in international waters off eastern Canada.

Delaware II

The vessel, which costs about \$1,400,000, is 155½ feet long, has a service speed of 12.5 knots, can cruise 8,000 miles, and stay at sea a month.

She is equipped for stern trawling, side trawling, clam and scallop dredging, long-lining, gill netting, and purse seining.



'Hybrid' Purse Seine Is Tested

BCF tested its fast-sinking, "hybrid" purse seine aboard the tuna purse seiner "Liberty" fishing off Oregon.

Although the Liberty was last to arrive on the fishing grounds, it was reported in mid-October to have caught more than the other vessels: 10 tons of bluefin tuna, 75 tons of albacore, and 60 tons of bonito.

Purse Seine Design Next

Enough was learned from making the net and testing it to go on to the next phase. This is the design of purse seines tailored to the net's length, depth, weight, and type of fishing planned for it.



Floating Trap Net in Oahe Reservoir Proves Effective

The effectiveness of a BCF-developed floating trap net used in Oahe Reservoir is surprising observers. The reservoir is on the Missouri River in South and North Dakota. During its first tests, the floating net took 33,043 pounds of buffalo fish in 187 lifts--177 pounds per lift. Conventional hoop nets took 30,285 pounds in 471 lifts--64 pounds per lift.

Other species, mostly carp and carp-sucker, made up less than 10 pounds per floating net lift--and less than 13 pounds per hoop net lift.



'Undaunted' Receives Satellite Photos

BCF's Undaunted has become the first fishing vessel to receive television photos transmitted from the ESSA VI weather satellite. The research vessel is taking part in the international program to study the distribution and biology of surface tuna and other fish in west African waters.

Undaunted's Receiver

The Undaunted has an automatic picture transmission (ATP) satellite receiver aboard. It records the picture transmitted from the satellite passing overhead. It is expected that such information will help BCF scientists locate and track productive water masses. If successful, inexpensive APT satellite receivers could be placed aboard commercial fishing vessel.



'Point of No Return' for Larval Anchovies Is Found

At 22° C., anchovy larvae could go without food for 3 days after hatching--or between 36 and 60 hours after the yolk was exhausted--and still exhibit good survival if they received food by noon of the third day. But if feeding was postponed until fourth day after hatching,

nearly all larvae died of starvation. Their survival curves were almost identical to those of control group that was not fed. This was learned in an experiment by Robert May, Biological Technician in the Behavior-Physiology program at the BCF Fishery-Oceanography Center at La Jolla, Calif.

The Experiment

Four groups of larvae were fed successively later times after hatching; a fifth group not fed, served as control. Mr. May followed the mortality in each container daily at noon.

"These results imply that the period of yolk absorption in the life history of the northern anchovy is less critical in terms of survival than might have been expected."



Can Fish Schools Be Spotted from Space?

During the Apollo 7 flight, BCF's "Oregon II" released Rhodamine B dyes and fish oils into the Yucatan Channel. It was part of a program to evaluate observations made from space. The observations may prove useful in detecting and assessing fish schools.

A Coast Guard plane flying between 400 and 10,000 feet photographed the waters in which the dyes and oils were released. These photos will be compared with those taken from the Apollo spacecraft.



La Jolla's 'Advisories' Benefit Fishermen

The Fishery-Oceanography Center at La Jolla, Calif., continued in September its successful daily albacore fishing information broadcasts and 15-day bulletin series. Albacore production continued to swell the record for the Pacific Northwest, especially for Oregon.

The La Jolla staff reports: "Our advisory services have earned a considerable number of favorable responses this season. When San Diego fishermen's wives telephone us for



a last-minute verbal appraisal to be relayed to their husbands who are pointing into 30-knot winds and 8-foot seas off Oregon at the time--we can only conclude that our service activities are hitting the mark!"



Scientists Bug Salmon

Salmon and steelhead trout have fallen prey to--spies.

For several years, James H. Johnson of the BCF Biological Laboratory in Seattle, Wash., and his crew of fishery researchers have been snooping into the habits of these species. The effectiveness of the sonic tags with hydrophone receivers developed in their Seattle electronics shop have led to a wave of spying by other scientists on a number of other marine species. Johnson has helped marine behavior studies from Canada to the Caribbean and from lobsters to humpback whale.

Tool for Migration Studies

The sonic tag and the hydrophone monitors that pick up its signal were developed as a tool to study migration of salmon and steelhead on the Columbia River.

The University of Wisconsin borrowed Johnson and his tracking boat for a salmon "homing" project. The team tracked one pink salmon over 50 miles--from Friday Harbor in the San Juan Islands of Washington State toward his home in British Columbia. The sonic-tagged salmon took a long way home. (Perhaps it was trying to shake the snoops.)

Other Species Tracked

Shore monitors and technical assistance were provided the Fisheries Research Board of Canada to obtain data from sonic-tagged Atlantic lobsters. The Canadians hope to re-settle this species off the coast of British Columbia. Similar equipment was loaned to track shad in the Connecticut River, and bull shark in the Rio San Juan of Costa Rica.

Once, Johnson went to Bermuda to join a team of scientists from Rockefeller University and Woods Hole Oceanographic Institution in an attempt to attach sonic tags to humpback whales. The whales outwitted the biologists at every turn. Finally, when tags were attached, the whales quickly brushed them off with a flick of their flippers.

BCF Bugging Since 1955

BCF has been bugging salmon since 1955, when the first crude tag and receiving equipment were developed. The tag was nearly 5 inches long, 2 inches in diameter, and transmitted for about 8 hours. Since then, miniature transmission packages have been developed. These make it possible to reduce tag size to about one fourth its original bulk and increase transmission time to 3 months. Originally, tags were attached to a salmon's back, where they frequently tore loose. Now they can be inserted in the stomach, where they have been known to remain until the salmon dies after spawning.

and steelhead trout disappear between major dams on the Columbia River. The biologists are determined to find the answer. In this sense, the studies aim to help the fish; in another, sonic research on salmon behavior in the sea may lead to more effective means to capture them.



A Salmon You Can Call Your Own

A simple method to brand young salmon for research purposes was developed and has been used for the past few years by BCF biologists in Seattle, Wash., and Auke Bay, Alaska. Fish branding is being used in studies of growth, behavior, migration patterns, and survival of young fish. Also, it may be used to identify and measure the contributions of many different stocks of the salmon fishery.

The branding irons are small and made of copper or brass. Their tips are solid silver to provide the most efficient transfer of heat. The irons either may be heated in boiling water (212° F.) or chilled with liquid nitrogen (-324° F.) for "freeze branding."

The irons are held lightly against the skin of an anesthetized salmon for about one second. The heated or chilled iron marks the fish with a visible brand that grows with the fish and can last its lifetime.



Study Fish Loss Between Dams

The last sounds heard from Johnson and his crew of biologists and technicians indicated they were completing a 2-year study aimed at finding the reason numbers of salmon

Many marks or combinations can be used so that individual fish or groups can be recognized easily by their own brands over long periods.



Culture of Oysters Off Bottom Advances

For the past dozen years, BCF has been experimenting with the off-bottom culture of oysters (*Crassostrea virginica*) along the U. S. east coast. Early studies at Cape Cod, Mass., showed that oysters suspended off bottom improved in "growth, survival, and quality."

Later studies in Chesapeake Bay showed excellent oyster sets can be obtained by suspending shells from rafts. In 1965, in one area, over 20 oyster spat per shell were col-

lected on suspended shells; this compared with 5 spat per shell on the bottom.

At the BCF Biological Laboratory at Oxford, Maryland, studies include the off-bottom culture of oysters in natural and man-made ponds. William N. Shaw has reported "preliminary findings indicate that natural ponds are excellent for growing and fattening oysters, and artificial ponds can be used to produce seed oysters . . . the off-bottom culture of oysters appears to have commercial application along the Atlantic coast."

The photos show aspects of off-bottom oyster culture in Massachusetts and Maryland.



Fig. 1 - Four $\frac{1}{4}$ -acre, man-made, salt-water ponds in front of BCF Biological Laboratory, Oxford, Md. Built above sea level, each pond is about 75 feet by 145 feet by 3.3 feet deep. Each holds about 312,500 gallons of water. The ponds have clay bottoms and sides. Dual pipe and pump systems permit weekly alternations and flushing to prevent fouling.

Oysters are being grown in these ponds. Some are on strings and suspended from rafts. (Photo: Robert Williams.)



Fig. 2 - Styrofoam rafts in Broad Creek, eastern shore of Chesapeake Bay, Maryland. Strings and bags of shells are suspended from rafts to catch seed oysters. The rafts then can be towed to growing area.



Fig. 3 - Strings attached to rigid structure. Growing on the strings are shells with oysters attached.



Fig. 4 - String of 1-year-old oysters grown from raft in Oyster Pond River, Chatham, Mass.



Fig. 5 - 2-year-old oysters grown from raft in Taylors Pond, Chatham, Mass.



'Cromwell's' Sonar Tracks Tuna Schools

A major mission of a cruise by the Townsend Cromwell in Hawaiian waters (No. 38, 8/14-9/13) was to collect data from CTFM sonar on movements of tuna schools and on their environment to investigate the association between them. (CTFM is continuous-transmission, frequency-modulated sonar.)

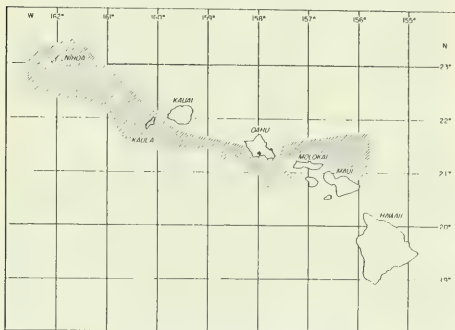


Fig. 1 - Area of operation, Townsend Cromwell, Cruise 38.

Nine tuna schools were contacted by the sonar: 3 medium skipjack tuna (8-12 lbs.), 4 small skipjack tuna (less than 4 lbs.), one medium yellowfin tuna (30-60 lbs.), and one was a mixed school of skipjack and yellowfin (8-12 lbs.). The schools were tracked by a combination of visual and acoustic means. Tracking ranged from 4 to 118 minutes, with a mean of 61 minutes. Bathythermograph samples were taken with each school. The salinity-temperature-depth recording equipment was not available throughout the cruise.

Ultrasonic Tags Used

A second major mission was to tag large fish with an ultrasonic tag and track with CTFM sonar.

Seven yellowfin tuna and one little tunny were tagged. The tags were cylindrical, ultrasonic ones 3 inches long, $1\frac{1}{8}$ inches in diameter, and emitting a pulse of 37 kHz (+200 Hz) at a rate of 1 per second. All fish were caught trolling on the banks near Nihoa Island and ranged in size from 50 to 80 cm. The selected fish were tagged immediately after capture, then released.

The tags were attached to the fish in three different ways: 1) attached by a monofilament line. A 35-cm. line, with tag attached at trailing end, was tied to caudal peduncle. 2) two hooks were attached to tag. The first was attached firmly to tag; the second was connected at end of a rubber band in a position opposing the first. The firmly attached hook was inserted at base of first dorsal fin, and the second hook was placed at base of second dorsal fin under tension of the rubber band. 3) tag was inserted into stomach via mouth. After 2 unsuccessful attempts--in which it was assumed tags had been regurgitated--4 prongs lined with plastic were attached firmly to tag to make regurgitation difficult. A reflex swallowing action occurred as soon as tag touched fish's throat and tag was partially swallowed. A tag's exposed end was forced the remainder of the way into stomach with a narrow pole.

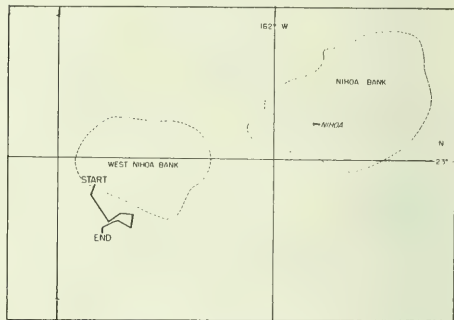


Fig. 2 - Path of tagged yellowfin.

Tracking Tags

A 40-50 cm. little tunny was tagged by the first method and tracked for 2 hours 11 minutes. Contact with the tag was lost at the bottom of the sea. The second method was attempted with a 75-85 cm. yellowfin. Contact terminated after 44 minutes, when the tag dropped rapidly to the bottom. Two 50-65 cm. yellowfin were tracked using the third method (without prongs). One fish was followed for 33 minutes, and the other only 1 minute. Contact was terminated in each case after tag was observed on sonar to drop rapidly to bottom. It was assumed the tags had been regurgitated. The first 2 yellowfin (80-90 cm.) that were tagged internally with the

modified tags were tracked for 6 and 23 minutes, respectively. Contact with tags ended while fish were still in midwater. It was assumed that either fish swam out of range or malfunction occurred in the sonar. Two more yellowfin (60-80 cm.) were tracked with modified tags for 5 hours and 58 minutes and for 7 hours and 54 minutes (fig. 2). In first case, tracking was discontinued after tag settled to bottom. The ship was anchored near tag, and the tag was still audible the following morning, 19 hours after it had been activated. In the second instance, contact with tag was lost shortly after fish began to sink to a 1,000-fathom depth.



'Jordan' Conducts Pacific Albacore Survey

The R/V David Starr Jordan cruised the waters off California and Oregon from mid-July to mid-August "to establish the distribution and availability of albacore in offshore waters during the middle of the Pacific coast season--and to test prospects for commercial exploitation of albacore beyond the traditional limits of the fishery (beyond 300 miles from shore)." (Cruise 26.) She covered 5,340 miles.

Albacore were taken every day in the survey grid, although fishing was not continuous throughout daylight hours because of schedule limitations. The computed catch-per-effort data gave good indications of commercial fishing potential from the easternmost line--127° W., to 131° W.--and between 40° and 45° N. in second-half July. Another good area was near 46° N., 127° W. in the second week of August.

Considering 100 fish per 100 line-hours to be the minimum for good commercial trolling (100 fish per day), there were 6 days out of 23 and 3 more that exceeded 90 fish per 100 line-hours.

Water & Tuna Body Temperatures

Gary Sharp of the Population Dynamics Program conducted a physiological experiment in which 450 blood samples were taken and 46 albacore body temperatures were recorded. Body temperature was lowest when

albacore were caught in waters having temperatures within the optimal catch-temperature range (62°-64° F.). "This is the first physiological evidence that corroborates the frequency vs. catch-temperature relationship derived from fishermen's logbooks over a 5-year period."

The sea-surface temperature in most of the survey grid encompassed a small range from 16.5° to 18.0° C. (61.7° to 64.4° F.). Fishermen's logbook records show that the major part of the commercial catch is taken in these temperatures. The thermocline was relatively shallow, between 20 and 30 meters. Except for the initial northbound leg (127° W.), the weather was fair and sunny with light winds offshore, but the coastal region had occasional strong northerly winds. The observed currents were very weak and were directed eastward at 135° W., and southward nearer shore.



'Jordan' Follows Fish Schools With Radar & Sonar

The David Starr Jordan cruised the waters off California (cruise 28) from Sept. 23-27 primarily to follow fish schools with the Deca radar-plotter and Simrad sonar and establish swimming speed of fish. This would be compared and evaluated with laboratory speeds and respiration studies.

The scientists developed a technique whereby fish schools could be positioned on the oscilloscope screen and tracking achieved by coordinated operation of sonar operator and captain. Ship speed was maintained at about 1½ knots and the fish school was kept at a heading to port side of vessel. The school was never permitted to get behind the ship, where the wake interferes with viewing. The distance from ship was recorded on the 30 kHz recorder. The following information was taken at intervals while school was in view: time of observation, distance to school, heading of school from due north, or some other bearing, and declination of Simrad transducer.

At the time of observations, the plotter was manually operated to indicate the point on a chart relative to all other positions.

What Scientists Found

The BCF La Jolla scientists reported: "We found that the Decca radar could be used by accurately positioning the ship between two points of land. An accuracy of measurement to 200 ft. or better was easy to maintain by manually dialing the plotter, keeping the two points of land positioned on the pre-set standardized concentric ring of the radar. Our best position was maintained between 'Ship Rock,' Catalina Island and Pt. Fermin on the mainland. The best area of operation was the lee of Santa Catalina Island because targets were always available except at night.

"The recorder of the sonar was extremely important because it provided a visual picture of the distance of the school from the ship." Also, it provided a continuity with time, so if school was lost momentarily on oscilloscope screen, the pick-up again could be verified by reference to the previous target mark on the recorder.

The scientists added: "We attempted two methods to identify the fish we were tracking--the first of these, dynamite, half pound to 1½-pound charges, exploded at the surface and at various depths to 100 m, was unsuccessful. No fish appeared at the surface after its use. The second method--a television camera maintained in the bow chamber--was similarly unsuccessful because the fish were either too deep or avoided the vessel." In one instance, the captain saw the anchovy school the scientists were tracking.

Results and Conclusions

The scientists concluded: "Once we familiarized ourselves with the potentialities of the equipment, we found that it was a simple matter for a team of two people to keep contact with a fish school for virtually any period desired throughout the day. The maximum time we followed any school was 2 hours and it seems certain that this could have been done for the entire day. . . no schools could be seen at night from about 1800 on. . . . Target identification remains the essential item of information still unknown."



'Delaware' Surveys Northern Shrimp in W. Gulf of Maine

The Delaware returned to Gloucester, Mass., on Sept. 13 after a summer shrimp survey in the western Gulf of Maine. (Cruise 68-8, Sept. 4-13, 1968.) The chart shows where concentrations of northern shrimp (*Pandalus borealis*) were found. This was the fourth in a series of cruises designed to collect data on the northern shrimp.

Otter trawl tows were made in 43 to 120 fathoms and caught 5 to 1,000 pounds of shrimp. Average size in individual catches varied from 36 to 50 per pound (whole shrimp).

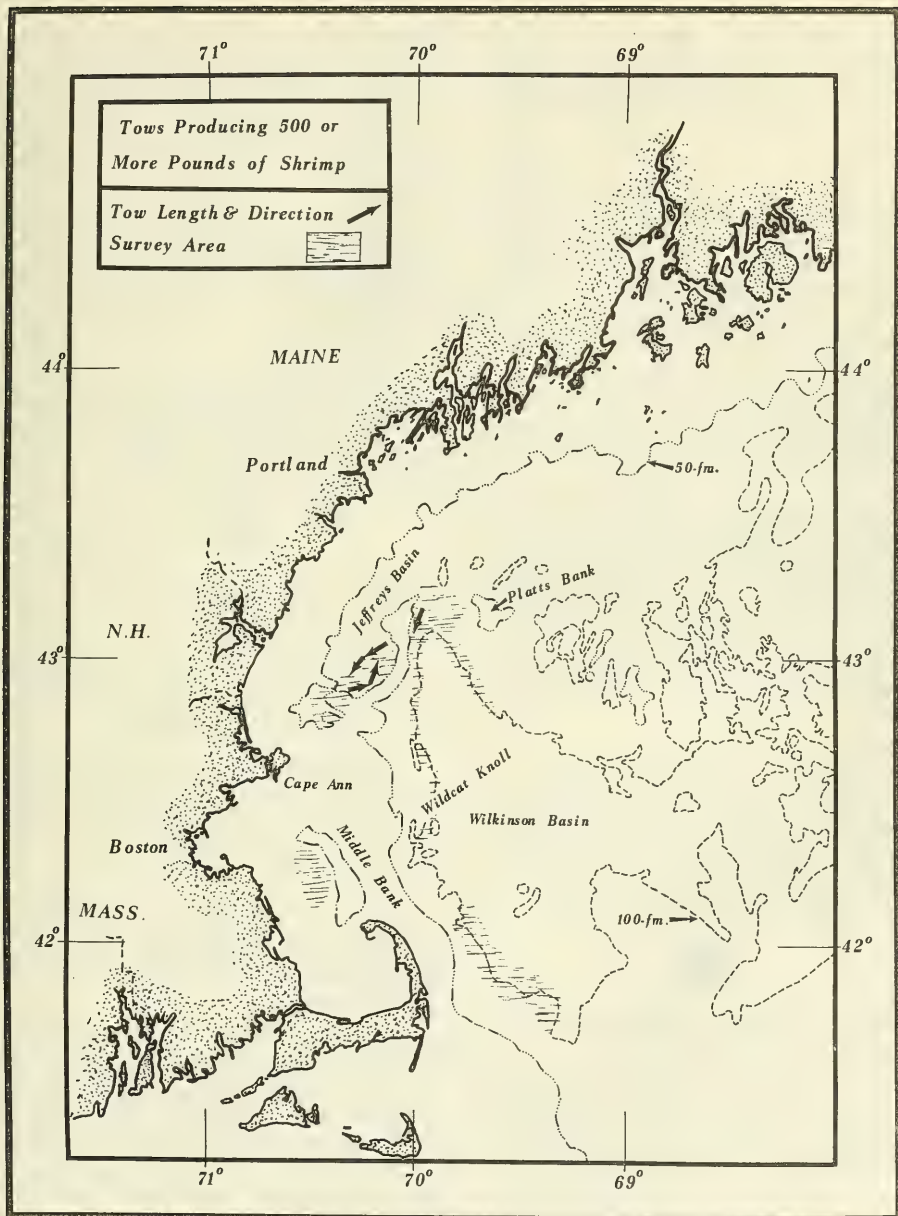
Procedure

A 70-foot, Maine-type, roller-rigged shrimp net was used for all fishing. Experience had shown that it was impractical to use a chain-rigged net in the sampling areas. All tows were 1 hour; they were shortened only because of hangups or soundings of very rough bottom. No exploratory try-net tows or night tows were made. Nighttime fishing for northern shrimp with bottom trawls proved unproductive during earlier cruises. Apparently, this was due to diurnal migrations of shrimp off the bottom during darkness. After each tow, data on catch size, pound count, and shrimp length were taken.

Results

Some shrimp were taken in each of the 37 tows completed. The average catch per tow was 220 pounds of shrimp, but 5 tows (14% of total) produced 500 pounds or more. This rate was about half the winter rate, when 30% of tows yielded 500 pounds or more of shrimps; it equals the 14% of the fall cruise and is 6% below the spring cruise figure. The length of shrimp varied from 11 to 34 millimeters; most were in mid-twenties range.

The best shrimp catch in the Middle Bank (Stellwagen Bank) area was 360 pounds. Catches of 1,000 pounds or more were made here during winter and spring surveys. Generally, the size of Middle Bank shrimp was the same as before--40 to 50 whole shrimp per pound. The percentage of egg-bearing female shrimp ranged from 91 to 54% and averaged 72% for all catches in this area. Trash fish and starfish were prevalent in all catches.



The catches from the Cape Cod area were considerably smaller than in the spring survey. The number of egg-bearers ranged from 32 to 40% and averaged 36%, considerably less than in other areas.

Wilkinson Basin

Fishing along western edge of Wilkinson Basin also was less productive than during spring cruise. One tow produced 500 pounds of shrimp and other catches ranged from 20 to 400 pounds. In the basin area, the size composition was about the same as in spring. The percentage of egg-bearers averaged 54% and ranged from 40 to 66% of all shrimp.

Better concentrations of shrimp were located north of Wilkinson Basin. Catches averaged 238 pounds compared to 137 in the Basin. However, the percentage of egg-bearing females was the same: 54%.

In the Jeffreys-Scantum Basin area, 4 of 8 tows caught 500 pounds or more. These catch rates about equaled spring rates. They indicated little change in population and distribution of shrimp since mid-May. The size composition was about the same as other areas, except for a small increase in proportion of larger shrimp. The percentage of egg-bearing females was higher than in other areas; it ranged from 60 to 95% and averaged 78%.

Other Species

Finfish were found to be generally abundant in all areas surveyed. In mixed catches containing many finfish, much of shrimp catch was crushed or softened by weight of fish in cod end. Moderate quantities of fish were removed easily from shrimp catches by the BCF-designed mechanical shrimp separator.



'Oregon' Collects Schoolfish Data in Atlantic Coastal Waters

The Oregon returned to St. Simons Island, Ga., on Sept. 17 after completing the fifth in a scheduled series of 6 bimonthly midwater schoolfish survey cruises in the Atlantic.

Purpose of the cruises is to obtain information on seasonal distribution and

schooling density of pelagic (open sea) schoolfish in coastal waters (5 to 20 fathoms) between Cape Hatteras, N. C., and Jupiter Inlet, Fla. Schoolfish data are obtained along standard transect lines and analyzed on a quantitative basis to establish exploratory and experimental fishing patterns along the south-east coast.

Continuous high resolution vertical acoustical tracings were obtained on 26 standard transects. Surface-water temperatures and vertical temperature profiles were obtained on all transects. (See chart on page 31.)

Heaviest Schooling

Heaviest schooling was recorded off Florida, east of St. Augustine; off Georgia, east of St. Simons Island, Sapelo Island, and Savannah; off the Carolinas northeast of Cape Romain, south and southeast of Cape Fear, and south of Cape Lookout.



'Gilbert' Tests Live Baits for Skipjack Tuna

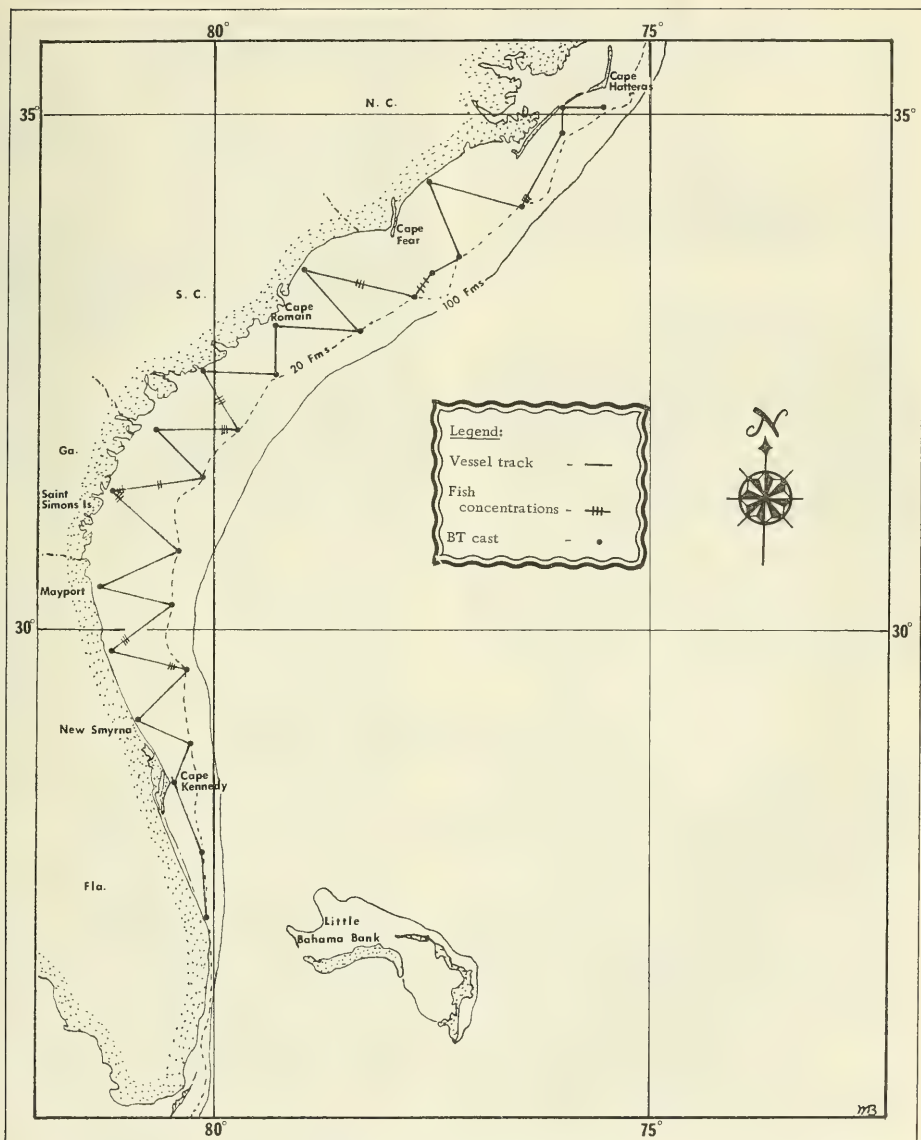
The Charles H. Gilbert cruised (No. 110) Hawaiian waters Aug. 21-Sept. 19 to test live baits in the pole-and-line fishery for skipjack tuna (Katsuwonus pelamis).

One bait tested was threadfin shad (Dorosoma petenense). Experimental pole-and-line fishing was conducted with 2 skipjack tuna schools using threadfin shad as bait, and with 4 schools using nehu (Stolephorus purpureus) as bait.

Seven schools of skipjack tuna were chummed with threadfin shad, and 9 schools with nehu. The success factor was 28.6 percent with shad, and 44.4 percent with nehu.

Ugui Tested

A second live bait tested was the ugui (Tribolodon hakonensis). Skipjack were absent and underwater observations were made by divers of ugui behavior when chummed from 100 percent fresh water and from brackish water (about 50% sea water). Small ugui (ca. 30-35 mm.) chummed from fresh water showed no signs of schooling or clumping together. Diving angles were estimated at 45°-60° and swimming speeds about



R/V Oregon Cruise 133, September 9-17, 1968.

1.1 ft./sec. A few reached 50 ft. They appeared rather shiny. Large ugui (50-55 mm.), chummed from either fresh or brackish water, also showed no signs of schooling. But they exhibited steeper diving angles (60° - 80°) and swam faster (ca. 2.4 ft./sec.) than small ugui. They swam vigorously, and many went deeper than 40 ft. The larger ugui did not appear as shiny as the smaller ugui.

Twice, a small amount of ugi was chummed during fishing and 16 skipjack tuna were captured.

Bait Altered Physiologically

The scientists also tested the effects of various species of fishes (tilapia, mosquitofish) as live bait by physiologically altering their behavior. This was done by dipping the baitfishes for 1 second prior to chumming into hot water, cold water, acetic acid (5%), and ammonium hydroxide (5%). Behavior observations were made by divers.

With skipjack absent, only acetic acid and ammonium hydroxide altered the behavior of tilapia (*Tilapia mossambica*). Schooling while diving was disrupted completely. With skipjack present, tilapia dipped in acetic acid did not get a chance to exhibit a behavioral change--because they were eaten almost immediately by the skipjack. Ammonium hydroxide was not tested with predators present.

Mosquitofish

Without skipjack present, the behavior of mosquitofish (a mixture of *Gambusia*, *Limia*, and *Mollienesia* sp.) was altered only by acetic acid and ammonium hydroxide, which induced somewhat faster swimming. With skipjack present, (a) mosquitofish treated with acetic acid behaved about the same as untreated mosquitofish; (b) mosquitofish treated with ammonium hydroxide swam somewhat faster than untreated fish, but both groups were eaten almost immediately. There were no obvious changes in skipjack behavior when preying either on treated or untreated tilapia or mosquitofish.



HOW FAST CAN A PORPOISE SWIM? IS IT THE FASTEST SWIMMING FISH?

Most porpoises can swim 17 to 23 miles per hour for short periods, although, to an observer aboard a ship, they may appear to be traveling much faster. There are records of porpoises being observed at 40 to 43 miles per hour, but they were swimming before a ship, utilizing the bow wave for extra speed.

Much research has been done to discover just how the porpoise is able to accomplish its high swimming speed. Either it is a much more powerful swimmer than expected, or it modifies its shape and, therefore, reduces hydrodynamic drag. The question is yet unsolved.

Although the porpoise is a very fast swimmer, it is not the fastest sea animal. Marlin, bonito, and albacore have been reported to swim at speeds of 40 to 50 miles per hour. The sailfish and swordfish have attained speeds of 60 miles per hour. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

ARTICLES

FOREIGN FISHING IN SOVIET WATERS

By William E. Butler*

The various nationalities inhabiting the coastal areas of the Union of Soviet Socialist Republics have fished for centuries. They were not alone. Since at least the seventeenth century, vessels from Great Britain and Scandinavia fished the Barents and White Seas; others from Japan, Korea, and China fished the Sea of Japan, the Okhotsk Sea, and the Bering Sea; Persian boats exploited the Caspian Sea; and still others from neighboring states operated in the Black and Baltic Seas.

Fishery resources seemed adequate for all, including the comparatively undeveloped Russian fishing industry. So until the nineteenth century, the Tsarist Government was relatively unconcerned about foreign fishing off Russian coasts.

By 1821, however, competition in seal fisheries was sufficiently intense to induce Tsar Alexander I to approve an edict reserving to Russia exclusive sealing and fishing rights within a 100-mile belt in the Bering Sea. (The "mile" used here is the Italian mile equal to 1.85185 kilometers.) After strenuous objections by the United States and Great Britain, the edict was abandoned in bilateral treaties with those countries in 1824-25. Thereafter, Russian jurists were highly critical of the edict, which they regarded as an unjustified extension of state jurisdiction.

Rejected 3-Mile Limit

Although Russia rejected the three-mile limit of territorial waters as a general rule of international law throughout the nineteenth century, the Government was reluctant to promulgate a broader limit to protect fishery interests. (By rejecting the three-mile limit as a general rule, Russia recognized the three-mile limit of other states but reserved the right to adopt a broader limit if her interests so required.) During the 1840's, Russian trading officials urged the Government

to extend territorial waters to forty Italian miles to reduce competition from foreign whalers. The Government declined. It stated that protests would result "since no clear and uniform agreement has yet been arrived at among nations in regard to the limits of jurisdiction at sea."

By the turn of the twentieth century, foreign competition on the northern and far eastern coasts, and the expansion of Russian fishing activity in coastal waters, increased pressure for restrictive legislation. Commissions appointed to consider the question recommended extending the limit of territorial waters to six, ten, or twelve miles. In 1906 one committee urged that a twenty-mile limit along the Murmansk coast be established, and that portions of the White and Kara Seas be closed to foreign vessels. Finally, in 1911, a twelve-mile fishing zone was incorporated into rules governing fishing on the far eastern coast of Russia, notwithstanding Japanese protests. Due partly to diplomatic pressure, a General Statute on Fishing adopted by the State Council in 1913 extending a twelve-mile fishing limit to all Russian coasts never became law.

PERIOD BETWEEN WORLD WARS

The succession of a Bolshevik regime in 1917 was accompanied by increased assertiveness regarding fishing rights. The Soviet Government "nationalized" its internal and territorial waters. In a decree of May 24, 1921, it created a twelve-mile fishing zone on its northern sea coast and the White Sea. That decree reserved fishing privileges only to those Russian citizens who had obtained special permits from the Main Administration for Fisheries and the Fishing Industry of the Russian Socialist Federated Soviet Republic.^{1/} Penalties for violations included confiscation of an offending vessel, its equipment and cargo, and fines for the vessel's master. Similarly, a decree of March 2, 1923, regulating

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^{1/}The USSR did not exist until December 1922, when the Republics of Russia, Ukraine, Belorussia, and Transcaucasia concluded a treaty establishing an all-union government. Today there are 15 union republics in the USSR. Each has legal competence to exercise jurisdiction in areas allocated by the USSR Constitution of 1936. Each republic, for example, has its own criminal code.

far eastern fisheries, annulled all prior treaties, concessions, contracts, and other conditions affecting fishing in the Sea of Japan, the Bering Sea, and the Okhotsk Sea. It established a twelve-mile fishing zone, thereby confirming the Russian decree of 1911. Limited access by foreigners to fishing grounds in the far east was permitted by auctioning parcels of the coastal area to the highest bidder in return for exclusive fishing privileges.

Other Soviet Measures

A decree on the Organization of the Fishing Economy of the RSFSR of September 1922, superseded by a 1927 statute, placed control over fisheries in virtually all portions of the sea coasts under the jurisdiction of the central authorities. Previously, local authorities had control over many such areas. Moreover, on February 2, 1926, the Soviet Union confirmed its adherence to the 1911 convention regulating sealing ratified by the Tsarist Government. Thus, within a few short years, the Soviet Government had taken vigorous measures to provide a legal basis for exclusive fishing rights within twelve miles of its coasts.

To appreciate the actual impact of Soviet fishing legislation, however, one must recall the international position of the USSR during the 1920's and 1930's. By 1921, the Soviet Union had just emerged from a debilitating civil war. It enjoyed little, if any, diplomatic support abroad. Soviet attempts to enforce the twelve-mile fishing zone in the north and far east produced sharp confrontations with Great Britain and Japan. Seizures and confiscations of British trawlers off Murmansk by Soviet patrol boats were countered by several diplomatic representations and intimations of naval reprisal. Confrontations with Scandinavian governments were less acrimonious because Soviet diplomacy soon found it desirable to conciliate neighboring states. Ultimately, the twelve-mile fishing zones created by the decrees were nullified in effect by bilateral treaties and informal agreements concluded with the protesting states.

Fishing Agreements

A provisional fishing agreement with Great Britain, May 22, 1930, permitted British fishing vessels to operate within three miles of

the northern coasts of the USSR and in specified portions of the White Sea. The agreement expressly provided that it did not constitute recognition or nonrecognition of the Soviet claim to a twelve-mile zone. This privilege automatically extended to Germany and Norway by virtue of most-favored-nation provisions in trade and navigation treaties signed by the USSR in 1925 with those states. Finland and the Soviet Union had reached an agreement about reciprocal fishing rights in territorial waters in the Gulf of Finland in 1922. Agreements signed with Japan in 1925 and 1928 were revised and renewed through 1940. The Soviet-Japanese agreements followed extremely difficult negotiations, and their provisions were sorely tested while they were in force.

In 1935 the Soviet Union adopted a comprehensive decree on fishing in which exclusive fishing rights in all Soviet territorial waters were unequivocally asserted. This decree, however, did not supersede treaties then in effect, nor did it define or delimit territorial waters.

Caspian Sea Unique

The Caspian Sea has a unique legal regime. General norms of international law relating to fisheries do not extend to the Caspian, whose regime is governed by Soviet-Iranian treaties. In a 1921 treaty of friendship with Iran, the RSFSR abrogated all treaties, agreements, and conventions of the Tsarist Government and annulled Russian concession rights in the Caspian. A 1927 fisheries agreement set up a joint Soviet-Iranian Company and granted it special concession privileges to catch and process fish. The concession lasted for twenty-five years. Iran elected not to renew the arrangement in 1953. However, it is bound not to grant a concession with respect to these fisheries to a third state for an additional twenty-five years. Each state has reserved a ten-mile fishing zone adjacent to its shore for vessels under its own flag; outside these zones, fishing may be engaged in exclusively by Soviet and Iranian nationals. The entire sea is open to fishing vessels of both states except in these zones, an arrangement confirmed in a 1940 Soviet-Iranian treaty. There has been no indication whether Soviet offshore oil drilling (now being conducted as far as seventy miles from shore) in the Caspian beyond the ten-mile zone has interfered with Iranian fishing.

THE POSTWAR PERIOD

Fishing concessions in Soviet waters were difficult to obtain after 1945. Catapulted to the status of major power by the war, the USSR was not disposed to allow foreign fishermen to operate within its twelve-mile limit. With the incorporation of Latvia, Estonia, and Lithuania into the Soviet Union in 1940, the twelve-mile limit was extended to Baltic coastlines. Enforcement resulted in seizure of numerous Danish and Swedish vessels in the late 1940's and early 1950's. The 1930 agreement with Great Britain was denounced in 1953 and renewed temporarily for 1954 and 1955. A new five-year agreement with Britain, which entered into force in 1957 and was denounced by the Soviet Union in 1961, has not been renewed.

In the far east, Japan was unable to renew the prewar arrangements. Large-scale arrests of her fishermen and vessels allegedly within the Soviet twelve-mile limit strongly colored Soviet-Japanese postwar relations. A 1957 Soviet decree declared Peter the Great Bay to be Soviet internal waters closed to foreign fishing. It probably was motivated primarily by strategic reasons: the naval port of Vladivostok is situated in Peter the Great Bay. The decree deprived Japanese fishermen of a rich fishing area. As the stronger power, the USSR has been generally successful in maintaining the integrity of its fishing zone and in persuading the Japanese to restrict fishing in the Sea of Japan and the Okhotsk Sea.

Limited Foreign Rights

At the present time, there are three agreements between the Soviet Union and adjacent states which give foreign citizens limited fishing rights in Soviet territorial waters. Pursuant to a 1959 agreement with Finland, renewed in 1966, the USSR consented to permit Finnish citizens resident in certain communes adjacent to the Soviet border to fish and seal in delimited areas of Soviet territorial waters in the Gulf of Finland.

Under a 1962 agreement between the Soviet Union and Norway, the latter's fishermen are permitted to fish in Soviet territorial waters in the Varanger Fiord until October 31, 1970.

In 1963 the State Committee on Fisheries^{2/} attached to the National Economic Council of 2/Renamed the (Soviet) Ministry of Fisheries in 1964.

the USSR concluded an agreement with the Japan Fisheries Association permitting certain fishermen to gather sea kale near the Island of Kaigara. The Association pays the Soviets 12,000 Japanese yen (US\$33.33) for each participating vessel. Nonetheless, Japan has been unable to achieve a satisfactory arrangement to fish in Soviet territorial waters in the far east. The 1966 Soviet-Japanese consular convention, however, may improve the legal protection of Japanese fishermen who stray into Soviet territorial waters.

Decree Concerns Conservation

In 1958 the Soviet Union adopted a Decree Concerning Conservation of Fishery Resources and the Regulation of Fishing in the Waters of the USSR. It supplanted the 1935 decree on fishing. Under the 1958 decree, all Soviet waters which are used or which may be used for the commercial extraction of fish and other marine life and growth, or which have significance for the reproduction of fishery stocks, constitute the economic fishery reserves of the USSR.

Soviet territorial waters, whose breadth was established at twelve miles by a 1960 Statute on the Protection of the State Boundary of the USSR, fall within the category of economic fishery reserve. They are closed to fishing, crabbing, or hunting of marine fur-bearing animals by foreign vessels, except as provided for by the international agreements discussed above. Foreign vessels violating this rule, or having permission to engage in fishing but conducting it in violation of the established rules, are subject to detention; persons guilty of so doing are subject to administrative and criminal penalties under USSR and union republic legislation. Articles 163-166, for example, of the 1960 RSFSR Criminal Code contain severe penalties for illegally engaging in fishing or other extractive trades, hunting seals or beavers, blasting in violation of rules protecting fish reserves, and illegal hunting.

CLOSED SEAS

As the cold war intensified after World War II, some Soviet jurists suggested the concept of the closed or regional sea as a theoretical justification for denying, or severely restricting, access by foreign vessels to seas contiguous to the USSR. The underlying

principle was that when certain geographic criteria were present, the regime of a given sea should be established exclusively by agreement of the contiguous states. This would also include rules governing fishing. Presumably, contiguous states would have the right to exclude the vessels of noncontiguous states from the closed sea. Soviet jurists have formulated the geographic criteria in such a manner that six of the fourteen seas washing Soviet coasts--the Okhotsk Sea, the Sea of Japan, the White Sea, the Baltic Sea, the Black Sea, and the Sea of Azov--would fall into the category of closed seas.

However, this theory has never been espoused by the Soviet Government. Yet it remains on the record as a distinctive Soviet

contribution to legal theory relating to freedom of the seas. It may haunt Soviet diplomats in the future, when smaller powers invoke Soviet doctrine to justify exclusion of Soviet high-seas fishing fleets from their offshore fisheries.

Soviet high-seas fishing is a recent phenomenon post-dating most Soviet legislation and agreements discussed in the article. Soviet law is a product of the period when Soviet fishing was primarily coastal. Having established a pattern of limiting foreign access to Soviet waters, it remains to be seen how the Soviet Union will treat its own precedent when the same principle is invoked by other states.

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WHAT IS THE VOLUME OF THE WORLD'S OCEANS?

Estimates vary from 317 to 330 million cubic miles; the most reliable sources place the volume at approximately 328 million cubic miles. Ocean waters comprise about 85 percent of the total water on the earth's surface.



The volume of all land above sea level is only one-eighteenth of the volume of the ocean. If the solid earth were perfectly smooth (level) and round, the ocean would cover it to a depth of 12,000 feet. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

ARE ESTUARIES NECESSARY?

By J. L. McHugh*

Those of you who are sport fishermen or duck hunters have heard a great deal about estuaries lately. You have been told, over and over again I am sure, that these rich borders of the sea are being altered rapidly by man and that these changes are contrary to your interests. As our population and our technology grow, the characteristics of the water are being changed by domestic and industrial pollution. Widespread use of highly toxic pesticides has been blamed for large-scale fish kills in many parts of the country. Recent fish kills in the Mississippi River have been attributed to pesticides, and some people think that these toxins also have caused the alarming disappearance of pelicans from the Gulf coast. In some places there are fears that artificial radioactivity is a danger to fishery resources. Even the common household detergents are known to have adverse biological effects on marine life. The extreme effects of these various chemical changes, which produce massive kills that everyone can see, often stir up enough public opinion so that something is done about the causes.

Scientists, however, are much more concerned about the more subtle effects of pollution. We do not really know very much about the effects of pollutants, but small pieces of evidence from individual scientific experiments tell us that the foreign substances we add to the water can affect marine life in many ways without killing. Even waste heat is a serious pollutant under some conditions. In the long run these unobserved effects may be more disastrous than those which pile up masses of dead fish on a beach. Changes in water quality may affect spawning, growth, feeding, resistance to disease, and many other characteristics of animals. The causes of these effects are very difficult to identify because natural phenomena also create wide variations in these characteristics.

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Author's Note: "This talk was presented at Annual Meeting of Sportsmen's Clubs of Texas, Driskill Hotel, Austin, Jan. 16, 1965. The issues and problems described are just as important today, and some are more acute. It was necessary to make some changes in the text to bring figures up to date or to incorporate new knowledge."

There is great concern also over the many physical alterations taking place in our estuaries. Channel dredging, filling of marshlands and shallow areas, dams and other water diversion projects, all create changes of one kind or another in the environment. Like the effects of pollution, some of these environmental alterations have obvious effects on marine life. It is not difficult to recognize the adverse effects of silt deposition on an oyster bed. The living oysters are smothered and die, and the bottom is made unsuitable for future generations of oysters. But engineering projects cause other, less dramatic, changes which alter current flows, change the salinity or temperature of the water, and create other conditions which may or may not be harmful to our fishery and wildlife resources.

We also must not forget the effects of these environmental changes on man himself. Animals have a remarkable capacity to concentrate within their bodies large quantities of pesticides and other chemicals. In the laboratory, for example, our scientists have demonstrated that oysters can accumulate concentrations of DDT many times greater than the concentration in the surrounding environment. This amazing power was illustrated dramatically by an experiment in which oysters held in running water containing one part of DDT per 100 million parts of water accumulated residues of 151 parts of DDT per million parts of water in 7 days! This far exceeds the permissible level in meat allowed by the Food and Drug Administration. Fortunately, we have never found such high residues in oysters in the natural environment, but the experiment shows that it could happen.

Engineering projects in coastal waters do not pose threats to man directly. In fact, they

are carried out for man's benefit. In many ways, however, they may lead indirectly to adverse conditions. For example, a deeper channel will increase the flow of shipping to a port. This will attract new industries, which will add to the load of industrial pollution. Industry in turn will attract more people into the area, adding to the flow of domestic pollution and hastening alteration of the shoreline for residential and recreational development. Growing industry and population will increase the demand for water, some of which will be lost entirely to the estuarine system. The remaining water will be altered in many ways before it is returned to the estuary.

What Is An Estuary?

We all talk knowingly about estuaries and their importance to man, but are we all agreed on what we mean by this term? The dictionary says that an estuary is an arm of the sea, or a river mouth, where fresh water from the land mixes with salt water from the sea. Nearly everyone agrees that an estuary has an arbitrary seaward boundary. Along the Texas coast this boundary lies across the passes which mark the entrances to Galveston Bay, Matagorda and San Antonio Bays, the Laguna Madre, and other protected coastal waters. On our Atlantic coast the seaward boundary of such well-defined estuaries as Chesapeake Bay, which is really a drowned river mouth, is a line joining the two headlands which mark the entrance from the sea, the historic Capes Charles and Henry.

Yet the notion of a geographically defined seaward boundary, to mark an area which owes its definition to mixing of river water with the sea, is quite illogical. You who live on the Gulf of Mexico know that the effect of the great Mississippi River is felt far beyond its mouth. The whole northern part of the Gulf is diluted with Mississippi water. As a child I remember reading and marvelling at stories of mariners approaching the Atlantic coast of South America who met the muddy waters of the mighty Amazon hundreds of miles at sea. The flow of these rivers varies seasonally to a remarkable degree. The legendary floods of the Mississippi carry more than 30 times the volume of water that flows into the Gulf during times of drought. Fluctuations in the Amazon drainage probably are even greater. It is inevitable that the seaward extent of mixing of land drainage with the sea fluctuates widely. This, in turn, must have

profound effects on the fishery resources and on all marine life.

We know that the kinds of fish and their abundance in the enclosed coastal waters vary seasonally and from year to year. Some of these variations are caused by temperature changes, but changes in the salinity or salt content of the water are important, too. I prefer to define an estuary entirely on the basis of mixing of fresh and salt water and to consider that this is a dynamic, fluctuating environment, not tied to fixed geographic boundaries. This coincides much more nicely with the habits of the fish, their migrations, movements, and fluctuations in abundance.

What Are the Typical Animals of An Estuary?

A complete catalog of the life of an estuary would be far beyond the scope of this article. Most abundant are the microscopic plants and animals, including bacteria, which drift freely in the water or cover the surface of the mud, sand, or other materials which form the shores and bottom. The most typical estuarine animals from the popular point of view probably are drifting jellyfish, so common at some times of the year; the various mollusks such as oysters, clams, mussels, and snails; and crabs of various kinds, especially the toothsome blue crab of the Atlantic and Gulf coasts. Then there are the abundant shrimp, especially the large species which support our most important fishery; and numerous migratory fishes. To most of you, I suspect, the most important fishes of the inshore waters are the croakers and sea trouts, jacks, and perhaps mullet. To me they are the anchovies and menhaden, for these herring-like fishes, although not eaten by man or caught by him for sport, are our most abundant estuarine fishes.

An important characteristic of these estuarine animals--the oyster and its molluscan relatives and a few other species excepted--is that they do not remain within the boundaries commonly considered to be the limits of the estuary. Instead, they migrate periodically into the open sea, sometimes far from land. We do not know very much about these migrations, but offshore sampling has told us that large quantities of marine life useful to man are to be found over the Continental Shelf in the Gulf of Mexico. This is a fairly recent discovery, for it was only a few years ago that scientists were saying that the Gulf was almost a biological desert, unable ever to yield a large fishery harvest.

Why Are Estuaries Important?

Much of the commercial fish catch of the United States is made up of animals which spend important parts of their lives in estuaries. Of the 10 most valuable kinds of fish in our commercial lands, 7 are typically estuarine. These 7 kinds--shrimp, salmon, oysters, crabs, clams, menhaden, and flounders--account for about 58 percent of the total value of our commercial fishery landings. In the Gulf of Mexico, estuarine-dependent resources supply about 90 percent of the commercial catch. For the entire U. S. seacoast, the catch is about two-thirds estuarine-dependent. Large numbers of these and other kinds of estuarine fishes also are caught by sportsmen. In fact, sport fishermen land greater quantities of some kinds of marine fish than commercial fishermen do. Thus, estuaries are very important to us as producers of commercial and sport fishery resources.

The sheltered waters near shore, which we commonly recognize as estuaries, are equally as vulnerable to alteration by man as are our inland lakes and rivers. We are using our rivers to a greater and greater degree as sewers for waste disposal. We are transforming the channels and shorelines with almost frightening speed. We are developing plans for water diversion which promise to perform miracles for flood control and agriculture, but which will alter forever the characteristics of our coastal waters. These developments are certain to affect the ecological balance in the estuarine environment. It is only prudent in the absence of thorough knowledge to assume that many of these changes will be adverse.

There are many gaps in our understanding of the estuarine environment. It is human nature to emphasize what we know, or what we think we know. Because we concentrate our human population on coastal areas, and move out on to the shallow coastal seas for our recreation, we are impressed with the wealth of life that we observe in these edges of the sea. There might be abundant life farther offshore in oceanic waters, but we venture out there less frequently and in smaller numbers. When we move offshore we do so in larger vessels, and in so doing we lose our intimate association with the sea surface and its bottom. Small wonder that we have become impressed with the bounty of our shallow waters. Our harvest from

these waters is greater than from any other natural area of equal extent. There is no doubt that the inshore estuaries are of great importance. For example, we know that shrimp, menhaden, and other important fishery resources spawn offshore, but great numbers of young find their way into the shallow, protected, inshore waters soon after hatching. The offshore waters influenced by land drainage also are important and we need to improve our knowledge of those waters. They may be as important as the inshore estuaries, and the offshore estuary can be affected by man's activities, too.

Many people believe that the rich biological productivity of estuaries is caused principally by the constant renewal of nutrients brought down by the rivers from the land. The rivers do contribute minerals and other substances essential to life, it is true, but the total amounts brought into the estuary by this mechanism often are small compared with the quantities brought in from the sea. It is not commonly understood that the relatively light river water flowing down from the land tends to spread out over the surface of the denser, saltier water of the sea, almost as a layer of oil will stay at the surface of the water. Oceanographers know that the energy contained in this seaward-moving land runoff at the surface generates a return flow of sea water along the bottom. The volume of nutrients in the deeper sea water flowing toward the land, in most estuaries, is several-fold greater than the natural nutrient load of the rivers. Thus, the secret of estuarine productivity is the constant inflow of ocean water, "plowing" and fertilizing the entire coastal zone. If runoff from the land increases, this process of enrichment increases in proportion. If runoff ceases, enrichment ceases, too. River runoff is the cause of estuarine productivity, but usually for a different reason than most people believe.

Along the Texas coast are two extreme types of estuary, the kind I have just described, in which runoff generates an inshore flow of salt water, and a kind like the Laguna Madre, in which loss of water by evaporation exceeds the total contribution from the land. The first is called a positive, the second a negative, estuary. The third kind, the neutral estuary, is one in which land runoff and evaporation just balance. It is interesting that a negative estuary also is enriched steadily with nutrients. Excess evaporation tends to

lower the surface of the water, and ocean water moves in to restore the balance.

The counter flow of fresh and salt water can extend far beyond the limits of the conventional inshore estuary. The entire North Pacific Ocean, north of about 45° N. latitude, is an estuarine zone by this definition, and it has been shown that beneath the vast surface lens of relatively low salinity water the deeper oceanic water flows in toward the land. On our east coast, off Chesapeake Bay, bottom-drifting markers released near the edge of the Continental Shelf have been recovered inside the Bay. This and other evidence show that the entire northwestern Atlantic north of Cape Hatteras and west of the Gulf Stream is an estuarine zone. A wide band of water along the northern coast of the Gulf of Mexico has similar characteristics. These are among the richest fishing grounds of the world.

What Is Man Doing to the Estuaries?

Fly over the coastal areas of the United States and marvel at the intricate patterns that nature creates. Over much of the Atlantic and Gulf coasts one still can be impressed by the vast salt marshes with their serpentine, branching drainage patterns, and the extensive bodies of quiet shallow water protected by offshore bars, peninsulas, and islands. But wherever one flies over this fascinating shoreline, one cannot fail to see scars created by man. In some areas miles upon miles of coast have been scalloped by residential developments in which every site is a waterfront lot. Marshes are criss-crossed by drainage and navigation channels. Waters are roiled by the furious activity of dredges, maintaining the controlling depth of navigation channels or making them deeper. Unsightly banks of mud and sand pile up in shallow water or on marshland as these dredges bite into the bottom and spew out their load. Great industrial plants throw smoke and flame into the atmosphere, almost blotting out the view in some areas. For miles downstream from these belching factories, the water is foul and discolored. Thousands of small boats churn the muddy bottom, or lie at their moorings, each a potential despoiler of the waters. Outboard motors, discharging their exhausts underwater, pour lead and combustion products into the environment. One thinks of the abundant marine life in these crowded waters and cannot conceive that these resources benefit from all this human activity.

Yet some of these same effects are produced by natural events. Strong winds scour the bottom, muddy the waters, and pile silt and sand in places new. Heavy rains or melting snow change runoff patterns, altering sharply the natural chemical characteristics of the water, and carrying tremendous loads of oxygen-demanding organic material down from the forests, the farmlands, and the marshes. Sudden weather changes cause sharp rises or drops in air temperature, which in these constantly moving, shallow waters quickly alter the temperature of the water. This is a harsh environment for animals, and it is certain that large numbers have been killed by such natural catastrophes from time to time, long before man appeared on the scene.

Thus, it is difficult often to identify the causes of fish kills, or of natural variations in abundance or migration patterns, because these effects can be produced by nature or by man. The principal difference is that nature's effects are not permanent, and the resources eventually recover from natural catastrophes. In fact, the animals have evolved for survival in this constantly changing environment, and many are favored by the natural changes they experience. Man-made changes, on the other hand, usually are permanent. We must be firm in opposing those environmental changes which we know are harmful to marine life. We must be equally as reluctant to accept changes which have less clear-cut effects, until we learn more about the influence of these changes on estuarine life. But we had better be quick to get the information we need, or we will not be able to stem the flow of "progress" very long.

Above all, we must be cautious about diverting the fresh waters that enter our estuaries. It is this flow which provides the energy to plow and fertilize estuarine waters and which creates the rich fishery resources with which our coastline is blessed. If this flow is stopped, or even substantially reduced, the fisheries will suffer accordingly. It is that simple.

Is Commercial Fishing Detrimental to Sport Fishing?

I cannot conclude without referring to the controversies that divide our fishermen and weaken their power to combat mutual problems. It is discouraging to see these conflicts between you, absorbing much of your



Fig. 1. Transformation of an estuary to increase the number of waterfront homesites. Such developments are typical of many estuarine areas in the United States. Marshland important to fish and wildlife is destroyed and the biological productivity of the area usually is seriously reduced.

BEFORE



AFTER



Fig. 2 - Destruction of valuable estuarine marsh by spoil from hydraulic dredging for real estate development. The mound in the right background is the discharge end of the dredge line. The widespread effect upon the marsh and water areas is readily evident.



NATURAL VEGETATED SHORELINE



BULKHEADED SHORELINE

Fig. 3 - A valuable nursery area for small shrimp destroyed by bulkheading. This is a typical example of man's increasing encroachment on our estuarine areas.

energy. After all, sportsmen and commercial fishermen have the same eventual objectives, which are to maintain the fishery resources in a condition that will produce the maximum possible yield. Dr. Gordon Gunter, the well-known Director of the Gulf Coast Research Laboratory at Ocean Springs, Mississippi, recently published an article^{1/} in which he exploded the principal myths which people use over and over again to "prove" that menhaden fishing is harmful to sport fishing. Although he dealt effectively with the alleged adverse affects of the commercial fishing, he failed to suggest some benefits that may accrue from menhaden fishing, by reducing their predation on eggs and tiny young of fish and shellfish valuable for sport. The menhaden is an omnivorous feeder, with a highly efficient straining apparatus that engulfs virtually everything in its path. Commercial fishing can reduce this predation, probably to the benefit of sportsmen. Some commercial fishermen, it is true, act unwisely by interfering with the pleasure of recreational boating and sport fishing. They give a wholly undeserved bad name to commercial fishermen as a group. There are hotheads among sportsmen, too, who are quick to condemn something they do not fully understand. To me, it is tragic that these two groups expend so much energy in criticism of each other, when they should be trying to understand each other and work together against common threats.

One or two examples might help to stress this point. Back in the early 1930's there was great concern in the State of Maryland over the apparent decline in production of striped bass. The Chesapeake Bay commercial catch had dropped rather steadily from about two million pounds in the 1880's to about half a million in 1934, and there was strong feeling that commercial fishermen were destroying the resource. At that time, it was believed strongly that large nets like purse seines, used to catch densely schooling fish like menhaden, were "destroying" large numbers of striped bass and other food and sport fish. Consequently, the Maryland Legislature enacted a complete ban on purse seines in Maryland waters. This law has been enforced rigidly ever since. Virginia, however, did not follow suit. Consequently, the menhaden fishery prospered in the Virginia portion of Chesapeake Bay, and the total catch of menhaden by the "destructive" purse seines prob-

ably has been little, if any, less than it would have been had Maryland not prohibited this gear. The result has been that the State of Virginia has collected the revenue, and her citizens have reaped the profits, that have accrued from this thriving fishery, while Maryland has gained nothing. And what has been the effect of this "destruction" on the striped bass resource? Catches have risen steadily. In the past 5 years, the average annual commercial catch has been about 9 million pounds, at least 18 times as great as it was 30 years ago! The sport catch probably has increased as much or more than this.

On the Pacific coast the once-great sardine fishery has gone. From a peak of almost 800,000 tons in 1936, the catch has dropped to insignificance. Despite very strict regulation of the fishery in recent years, there has been no evidence of recovery. Intensive scientific studies of the California Current system since 1950 have uncovered some interesting facts, however, which help to explain this decline and failure to recover. The abrupt collapse of the sardine fishery in 1946, following a ten-year period of good catches, was almost certainly caused by a combination of intense fishing and a sharp reduction in success of sardine spawning. The spawning failure probably was caused by a temporary change in oceanographic conditions. The sharp reduction in sardine abundance allowed the Pacific anchovy, a species well fitted to compete with the sardine, to multiply and fill the gap. The evidence pieced together by the scientists shows clearly that the anchovy has increased tremendously in numbers. It now is at least as abundant, possibly more abundant, than the sardine ever was. What is needed is a carefully controlled scientific fishing experiment to measure the effects of an anchovy fishery on the numbers of anchovies and sardines. But the powerful California sport fishermen's organizations, convinced that anchovies are an essential food of the most important sport fishes, were for years successful in blocking such proposals. The commercial anchovy fishery is so severely regulated that it is producing only a very small fraction of the catch that it probably could sustain. The result is that hundreds of thousands of tons of Pacific anchovy are living their normal life span and dying a natural death, wasted so far as man is concerned. Uncontrolled commercial fishing should not be allowed, but we need to know the

^{1/}"The Gulf of Mexico menhaden fishery in relation to the sports fisheries," Proceedings of the Gulf and Caribbean Fisheries Institute, 16th Annual Session, Nov. 1963, pp. 99-108.

annual surplus production of anchovies that can be taken safely by commercial fishermen without damaging the resource or interfering with sport fishing.

What Can We Do?

By now I am sure it is clear to you that the question posed in my title has only one answer: "Yes, estuaries are necessary to maintain the rich harvest of the edges of the sea around our coasts." I am sure it is also clear that we do not know all we need to know about this important environment and its living resources. Moreover, I hope you have recognized that many of the things we think we know do not fit the facts. For example, from the point of view of the fisheries, we should recognize the estuaries often extend their influence many miles seaward. The most important thought I can leave with you is to urge that you recognize the need to improve our understanding and to give weight to demonstrated facts instead of opinions in planning for better fishing.

The Federal Government, the States, and private organizations have spent a great deal of money in scientific research on the ocean and its living resources. The knowledge that has accumulated is scattered in a great variety of scientific journals, official reports, personal files, or in the minds of those who did the work. Other valuable information on fishery resources is contained in fishermen's logs, license records, and in the personal experience of commercial and sport fishermen. Never has this vast store of information been gathered together and analyzed thoroughly. On the rare occasions when limited attempts have been made to synthesize existing knowledge, a surprising wealth of useful knowledge was revealed. It seems to be a common failing to ignore this treasure trove of existing knowledge in the rush to deal with urgent problems of the moment. We should encourage competent specialists to accumulate, analyze, and interpret what has already been gathered.

Such summaries have two distinct benefits. They demonstrate, usually to the surprise of everyone, that we know much more than we had realized. Secondly, they sharpen our planning by pointing out the gaps that need to be filled. By proceeding in this systematic fashion, it is possible to put available knowledge to work immediately and to fill in the missing pieces as quickly as possible. These simple principles are the essence of any successful business enterprise. It is quite astounding that we so seldom have applied

the same principles to our resource utilization problems.

We must recognize that change is an inherent characteristic of natural events. Thus, the abundance and behavior of marine life are certain to fluctuate from natural causes, and it will be a long time before we learn how to control these natural variations, if indeed we ever can. We will always be tempted to blame these natural fluctuations on the disturbing forces created by man. Indeed, there will be many occasions when it will not be possible to say whether nature or man was the culprit. When our lack of knowledge forces such a conclusion it is impossible to deal effectively with human causes. We will always be able to cope most efficiently with man-made causes if we keep open minds and recognize that natural forces sometimes, although by no means always, are far more powerful and widespread than our own. And finally, we must always remember that well established facts and judgment are the best tools for solving problems.

In the long run we will protect our natural resources best and will gain the greatest use and enjoyment from them if we bring all the facts and all the interests together. We cannot wait for complete information before we act to conserve our resources, for our information never will be complete, nor will the necessary steps be as clearly defined as everyone would wish. But the wisest actions, even with incomplete knowledge, are those which attempt to marshal all available facts objectively. We should avoid the traps that we so very often set for ourselves by attacking only one small part of the problem, creating much more heat than light. By hasty action we often dissipate our energies on details and so have no power left when it is needed most. Are Estuaries Necessary?

Yes, estuaries are necessary if we are to preserve the natural productivity of our coastal waters. But we had better be sure we know what an estuary is. Water flow is the answer, and reduced runoff could be the most crippling blow. We could, of course, provide artificial sources of energy as a substitute, but the cost would be prohibitive. Maintaining the water supply is not the only requirement, however. The quality of that water must be guarded just as jealously as we guard the supply. Finally, we must make full use of existing knowledge, and interpret it intelligently. With the present status of our knowledge thoroughly understood, we can proceed to fill the gaps with facts instead of opinions.

THE FISH-FINDING SONAR OF "OREGON II"

By Donald A. Wickham* and Shelby B. Drummond*

Horizontal scanning sonar for fish finding has developed considerably in the past decade. It has become indispensable to the purse-seine fishermen of northern Europe, whereas aerial spotting is used by American purse-seine fishermen for locating fish schools. This difference may be due, in part, to unfavorable experiences with early models of sonar; these were usable only in deep water, were expensive, and required extensive training in sonar operation and interpretation. New interest in the use of sonar was aroused in the Gulf of Mexico purse-seine fishery by sonar demonstrations aboard the BCF exploratory fishing vessel Oregon II during the last quarter of 1967.

Personnel of the BCF Exploratory Fishing and Gear Research Base at Pascagoula, Miss., were exposed to the newly installed, high powered, horizontal-scanning sonar aboard the Oregon II (recently delivered by the builder). Portions of the shakedown cruise were devoted to familiarizing personnel with the operations and capabilities of the sonar. This activity is one of the main purposes of the Base's Sonar Technology Program.

This paper outlines some methods used during our preliminary trials and the limitations we discerned in using sonar.

DESCRIPTION OF SONAR EQUIPMENT

The sonar aboard the Oregon II operates at a frequency of 20 kHz (kilohertz = 1,000 cycles per second). Two acoustic power modes, 4.5 kw. (kilowatt) and 0.5 kw., can be selected manually for matching with pulse durations of 1, 3, or 10 milliseconds. This sonar can be operated at four range scales: Range I (0-275 fathoms), Range II (0-550 fathoms), Range III (0-1,100 fathoms), and IV (0-2,200 fathoms). The sonar beam configuration, measured at the -3 decibel level, is slightly elliptical in cross section, being 13° horizontally and 15° vertically. A shallow-water suppressor circuit was installed

in the unit to reduce bottom echo interference. This change permits effective school location in water as shallow as 4 fathoms (safe inner limit of operation for Oregon II).

METHODS

As the personnel of the Sonar Technology Program gained proficiency in the use of Oregon II's off-the-shelf sonar, attempts were made to evaluate its suitability for delineating horizontal dimensions of fish schools. The effective use of sonar to estimate fish school dimensions requires accurate determination of the distance between the school and the sonar transducer (range), complete penetration of the acoustical signal through the school (horizontal school width), and accurate determination of the degrees of arc (scan degrees) occupied by the school.

The number of degrees of scan through which a school could be detected was determined from the transducer bearing indicator, the equivalent of the center of the sonar beam. If we assume that acoustic power sufficient to generate echoes from a fish school would be within the known beam angle of 13°, a correction factor of one beam width of 13° could be subtracted from the scan angle determinations to establish more accurately the degrees of arc occupied by the school. This is the reason for the correction: When the sonar beam is scanned across a fish school, an echo is picked up when the leading edge of the beam first contacts the target, about 6.5° ahead of the center of the beam in this example (fig. 1). Similarly, as the beam is scanned past the target, the trailing edge of the beam should record the target for about 6.5° behind the center of the beam.

Sonar scans of fish schools were made in conjunction with the Base's Aerial Fishery Survey Program. Measurements taken from aerial photographs of scanned fish schools were used to compare sonar measurements. In this evaluation, the greatest school

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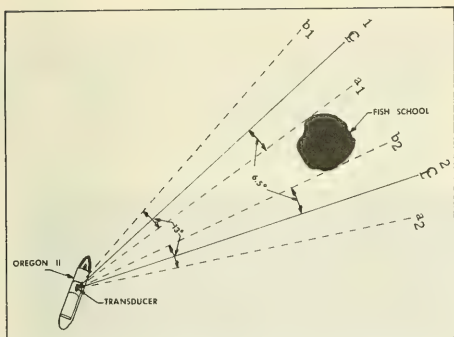


Fig. 1 - Schematic illustration of sonar beam pattern initiating fish school echoes during scans: (1) center of sonar beam approaching fish school, (2) center of sonar beam passing beyond fish school, (B) center line of sonar beam as indicated by transducer bearing indicator, (a₁) leading edge of sonar beam with sufficient acoustic power to generate a detectable fish-school echo trace, (b₂) trailing edge of sonar beam with sufficient acoustic power to generate a detectable fish-school echo trace.

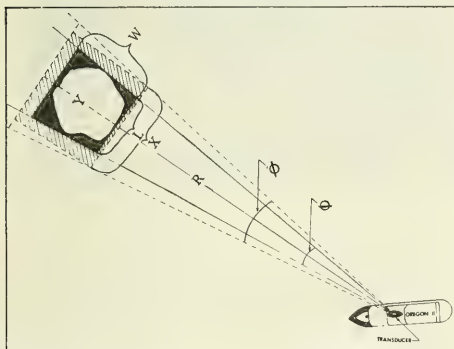


Fig. 2 - Schematic of measurements of fish school taken from aerial photograph; school angle (θ), school width (W), and school length (L), superimposed over measurement of the same fish school determined from sonar data; scan angle (ϕ), sonar trace length (Y), calculated school length (X), and school range from the vessel (R).

dimensions from the photographs were used because these dimensions more closely approached the type of data obtained from the sonar. Figure 2 shows the method used to obtain fish school dimensions from photographs and to reconstruct school dimensions from sonar data.

The sonar tape provided an estimate of school range and school width along the sonar beam axis. The degrees of arc occupied by the fish school (scan degrees) were read directly from the sonar transducer bearing in-

dicator and were recorded during each scan of a fish school. Using this sonar data we could estimate greatest horizontal length, perpendicular to the sonar beam for the school by the formula $L = R \tan \phi$ where:

L = school length (feet)

ϕ = scan angle (degrees)

R = range or distance (feet) from the sonar transducer to the near side of the fish school

RESULTS

The range and estimated horizontal school widths from the sonar traces appeared to be within the limits of measurement error when compared with the school dimensions from the aerial photographs. Apparently the 4.5-kw. sonar acoustic signal was powerful enough to be reflected from fish on the near side of the school as well as to penetrate through the school to the far side, providing a sonar trace indicative of the school width. Reverberation on the far side of the school apparently did not significantly extend the sonar trace, as frequently occurs during vertical echo sounding.

Comparisons of sonar and aerial photograph measurements revealed considerable differences in values for scan angles and, consequently, calculated school length. The maximum surface area of a school determined from the photograph was compared with the surface area calculated from the sonar data. The discrepancy in surface area estimates by the two methods is shown in figure 2 and in table.

The photographic and sonar measurements in table were taken from the aerial photograph (fig. 3) and sonar trace number 1 in figure 4. This example contains data from one of our better sonar-aerial photograph comparisons. Most of our preliminary evaluations of fish-school dimensions did not agree as closely as the example; however, we wish to emphasize that the sonar aboard the Oregon II was not designed to obtain scientific acoustic measurements. Insufficient knowledge of acoustic signal transmission and the variable accuracy of sonar data among operators appeared to be the major sources of discrepancy between sonar and photographic data for the determination of fish school dimensions. An estimate of operator error could have been determined if sufficient scan-photo combinations had been available for statistical treatment. Any

Comparative Measurements from the Fish School in Figures 3 and 4

Method	School Range	Scan Angle	School Length	School Width	Calculated Surface Area
	Feet	Degrees	Feet	Feet	Square Feet
Photograph	1,343	7	141	101	14,241
Sonar:					
Without angle correction . . .	1,345	21	516	93	47,988
With 13° angle correction . .	1,345	8	189	93	17,577



Fig. 3 - Aerial photograph of fish school (marked by circle) being scanned by sonar aboard the Oregon II. This school was believed to be composed of thread herring, *Opisthonema oglinum*.

further elimination of error would require calibrating the sonar equipment and evaluating the echo characteristics of fish schools.

The difficulty in obtaining fish school dimensions and calculating their surface areas was further compounded by the constant amoebalike changes in the fish school configurations. Figure 5 shows examples of variability in fish-school surface patterns.

Fish-finding sonars are designed primarily to locate fish schools or other targets at a distance from the vessel, and then are used to direct the vessel for effective capture of the target. The sonar aboard the Oregon II was capable of detecting fish schools at a range of at least 800 fathoms, and then was used to direct the vessel over the school for target confirmation by vertical echo sounder. Under favorable conditions,

nonbiological targets were detected at distances up to 2,000 fathoms. The Oregon II's sonar functioned satisfactorily in relatively shallow water; the echo discrimination characteristics were improved by using shallow-water suppressor circuitry. The sonar's effective range was restricted slightly in less than 10 fathoms and in rough seas.

The value of sonar for supplementing aerial reconnaissance was clearly demonstrated during the initial cruise. Thread herring schools were abundant off the west coast of Florida while the sonar was being tested. Following BCF advice, several commercial purse seine vessels with aerial fish spotters had moved into the area. On several occasions, when water turbidity and lighting conditions were unfavorable for reliable aerial detection, the sonar aboard the Oregon II was used to direct the purse seiners to fish schools.

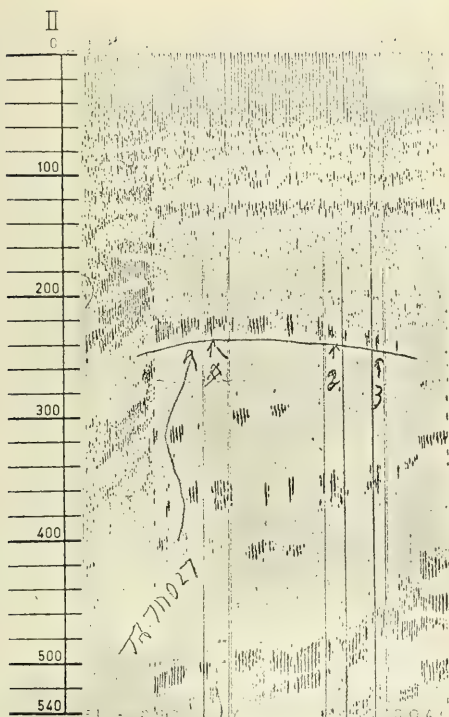


Fig. 4 - Sonar paper tape of fish school circled in fig. 3. The scale is calibrated in fathoms, and the effective range of the sonar extends beyond the scale in this illustration. Measurements of this fish school are given in table.

The vessel returned to the area of fishing off west Florida during December when the fishing industry asked for sonar assistance. As a consequence of this sonar demonstration, some industrial fish companies have considered equipping vessels with sonar.

This preliminary sonar experience has provided a nucleus of trained sonar operators



Fig. 5 - Aerial photograph of fish schools (thread herring) showing variability in their surface configurations. A dye marker dropped by the photo airplane can be seen near the Oregon II.

who familiarized other Base personnel with applications of fishery sonar. For the reader interested in the principles of sonar operation and fishing tactics, this information is presented in two books by D. G. Tucker, "Underwater Observations Using Sonar" and "Sonar in Fisheries," both published by Fishing News (Books) Ltd., London.

Our early field work has revealed problems associated with acoustical measuring techniques and has provided sufficient background experience to develop program aims and equipment requirements for future efforts of acoustic fish-school evaluation.



An annual summary useful to industrial and scientific groups.

THE 1967 ATLANTIC COAST SURF CLAM FISHERY

By Robert M. Yancey*

The 1967 landings of the surf clam (*Spisula solidissima*) fishery equaled the record of 45 million pounds of meats set in 1966. About 92 percent of the total landings were made in New Jersey, 5 percent in New York, and 3 percent in Maryland. Point Pleasant landings contributed about 55 percent and Cape May-Wildwood 44 percent to the New Jersey total. Daily catches averaged 220 bushels at Point Pleasant and 233 bushels at Cape May-Wildwood. This catch is about 30 percent less than in 1966. Hours fished per day increased and catch per hour decreased at both New Jersey ports. Clams landed had a mean shell length of 149 mm. (6 in.) at Point Pleasant and 141 mm. (5½ in.) at Cape May-Wildwood.

The surf clam fishery contributed about 35 percent to total U. S. molluscan shellfish landings in 1967.

This report is the third of a series to document yearly activities of the fishery and to summarize statistics. Data for the two previous years were reported by Groutage and Barker (1967a, 1967b).

FISHING AREAS

The New Jersey fishery has two centers--one off Point Pleasant and the other off Cape May (fig. 1). In the past few years, 76-80 percent of the New Jersey catch came from the Point Pleasant fishing grounds and 20-24 percent from off Cape May. New Jersey production was more evenly divided between the two areas in 1967, when the landings were about 55 percent at Point Pleasant and 44 percent at Cape May-Wildwood. As catch per hour dropped slightly at Point Pleasant, more boats moved to Cape May-Wildwood where the catch per hour was better (fig. 2).

Also, the Cape May-Wildwood fishing area changed in size and location in 1967 as the result of more exploratory trips by the enlarged fleet.

Surf clams landed in New York were taken off the southern coast of Long Island, and those in Maryland from off Ocean City.

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FLEETS AND METHODS

A dredge fleet of 34 vessels, 11 fewer than in 1966, fished the Point Pleasant area. The fishing ground was between Barnegat Lightship and Point Pleasant. Clam beds in this area were 15 to 33 meters (50 to 108 feet) deep; average depth fished was 22 meters (73 feet). Most vessels made 1-day trips during daylight, as did surf clam vessels in all areas, but some fished overnight. Hours fished per trip varied from 1 to 15. Monthly averages of hours fished per day per boat are shown in figure 3. The average for the year was 8.8 hours. This time was 1.5 hours less than the yearly average in 1966. Dredge hauls continued at 4 per hour.

The Cape May-Wildwood fleet consisted of 26 vessels, an increase of 16 since 1966. Part of the increase resulted from a shift of boats from Point Pleasant; 5 vessels were new to the fishery. The depths of clam beds in the Cape May fishing area ranged from

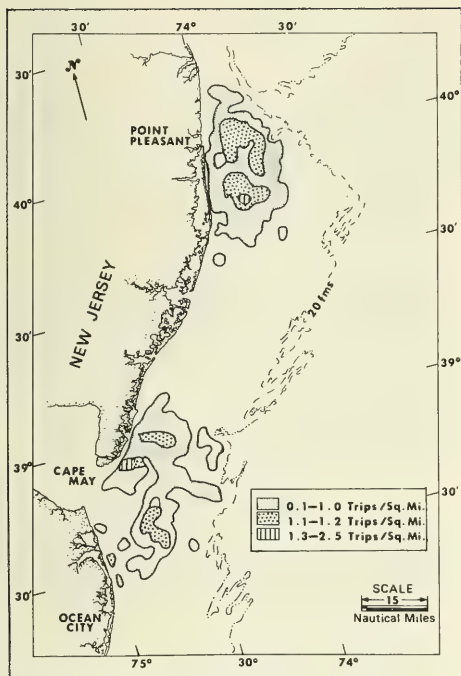


Fig. 1 - Area and intensity of surf clam fishing by New Jersey fleet, 1967 (based on 744 interviews).

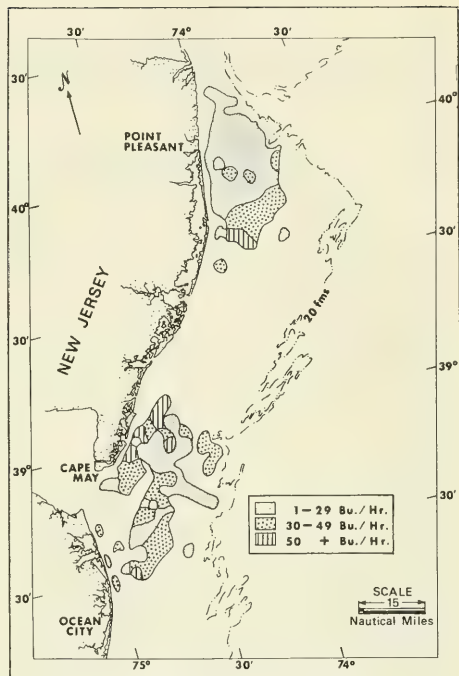


Fig. 2 - Catch per hour within the area fished by the New Jersey surf clam fleet in 1967 (based on 744 interviews).

5.5 to 24.4 meters (18 to 80 feet). Average depth was 12 meters (39.5 feet). A few boats occasionally fished at night, but most fished during daylight. Hours fished per trip varied from 1 to 20 and the average fishing time per trip was 7 hours, an increase of 1 hour from 1966. Monthly averages of hours fished per day per boat are shown in figure 3. Three dredge hauls per hour were made in 1967, and 4 per hour in 1966.

The New York fleet consisted of at least 5 boats. One of these entered the fishery in spring 1967.

Two vessels fished all year out of Ocean City, Maryland, and other vessels fished there at irregular intervals. In 1966, only one boat fished the area, and only part of the year.

LANDING STATISTICS

Information on fishing areas and effort was obtained from interviews with vessel captains. Data on the amounts of surf clams landed along the Atlantic coast were taken from Current Fishery Statistics--or from data provided by personal communication from Fishery Reporting Specialists, BCF, Office of Statistical Services, in the respective states.

Total landings of 45 million pounds of meats equaled the record set in 1966 (Groutage and Barker, 1967b). The percentage contributed to the total by New Jersey was less in 1967--92 percent, 41.6 million pounds--than the 96 percent (43.2 million pounds) in 1966. New York landings rose from 4 percent in 1966 to 5 percent (2.3 million pounds) in 1967;



Fig. 3 - Monthly averages of daily effort (upper) and catch per hour (lower) at Point Pleasant and Cape May-Wildwood, New Jersey, 1967.

Maryland landings increased from 0.2 percent in 1966 to 3 percent (1.2 million pounds) in 1967. The portion of the total landings used for fish bait (sport and commercial fishing) continued to be small. About 1.8 percent (700,000 pounds) of the New Jersey landings were used as bait.

Landings in Rhode Island and Massachusetts remained insignificant and were used entirely for fish bait.

The shift in effort from Point Pleasant to Cape May was reflected in the proportion each area contributed to the New Jersey landings. Point Pleasant contributed 76 percent in 1966 but only 55 percent (22.9 million pounds) in 1967. Daily landings per boat ranged from 75 to 535 bushels (1,275 to 9,095 pounds of meats) and averaged 220 bushels (3,740 pounds). The average in 1966 was 332 bushels (5,644 pounds). The catch per hour (fig. 3) in 1967 averaged 25 bushels (425 pounds of meats); it was 35 bushels (593 pounds of meats) in 1966. Catch per hour remained generally steady during the year. Monthly landings fluctuated widely from 2.5 million to 1 million pounds of meats (fig. 4).

Weather was probably the most important factor influencing the size of the monthly landings.

Cape May-Wildwood

The Cape May-Wildwood share of the New Jersey landings increased from 22 percent in 1966 to about 44 percent (18.4 million pounds of meats) in 1967. Daily catches per boat ranged from 98 to 1,120 bushels (1,666 to 19,040 pounds) and averaged 233 bushels (3,961 pounds). This catch was a decrease from the average per day per boat of 315 bushels (5,355 pounds) in 1966. Catch per hour (fig. 3) averaged 34 bushels (578 pounds) as compared to 53 bushels (893 pounds) in 1966. Catch per hour was high in the first 2 months of 1967, but it declined sharply in April and continued a slow decline for the rest of the year (fig. 3). Monthly landings ranged from 1 to 1.9 million pounds of meats. Sizes of landings were irregular (fig. 4), probably as a result of weather.

Monthly averages of the lengths of surf clams landed at Point Pleasant fluctuated somewhat, and the general trend was downward during the year (fig. 4). The monthly average lengths were more uniform, however,

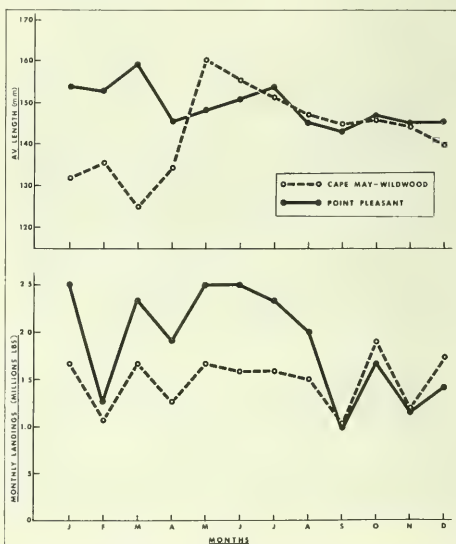


Fig. 4 - Monthly mean lengths of clams (upper) and landings of surf clam meats (lower) in New Jersey, 1967.

than those of clams landed at Cape May-Wildwood. The mean length of 4,440 clams sampled throughout the year at Point Pleasant was 149 mm. (6 inches); the range was 110 to 185 mm. ($4\frac{1}{4}$ to $7\frac{1}{4}$ inches). Mean length of clams landed at Cape May-Wildwood was based on measurements of 3,760 clams taken at random throughout the year. Mean length was 141 mm. ($5\frac{1}{2}$ inches); the range was 95 to 178 mm. ($3\frac{3}{4}$ to 7 inches). Monthly average lengths at Cape May-Wildwood increased sharply in May, and then decreased slowly for the rest of the year (fig. 4).

About twice as many clams less than 130 mm. (5 inches) long were discarded at sea than in 1966. About 3 bushels were discarded at sea for every 100 bushels landed at Point Pleasant, and about 6 bushels for every 100 bushels landed at Cape May-Wildwood.

STATUS AND TRENDS OF THE FISHERY

Fishing effort tended to shift southward in 1967. Some clam vessels left the Point Pleasant fishing area to dredge clams off Cape May. Five new boats joined the Cape May (N. J.) fishery, but only one was added to the Long Island, New York, fleet. Two boats fished full time and several others at irregular intervals out of Ocean City, Maryland, where only one fished part-time in 1966.

The average length of Point Pleasant clams was 149 mm. (6 inches) in 1967--2 mm. less than in 1966. The 1967 average length of Cape

May clams was 141 mm. ($5\frac{1}{2}$ inches), appreciably greater than the 130 mm. (5 inches) average length in 1966. The average length of Cape May-Wildwood clams increased because a decline in demand for smaller clams prompted more of the fleet to fish offshore rather than inshore.

Catch per hour decreased at Point Pleasant and Cape May. The decrease of 10 bu. per hour (29 percent) at Point Pleasant from 35 bushels in 1966 to 25 bushels in 1967 was reflected in the increased reliance on the Cape May area to provide clams for processing. The catch per hour at Cape May decreased 36 percent--from 53 bushels per hour in 1966 to 34 bushels per hour in 1967. The decreased rate of catch at Cape May was caused by the fleet shifting its efforts from the dense beds of small clams inshore to offshore beds. The fleet did this to obtain larger but scarcer clams needed by processors.

The number of vessels fishing off Ocean City, Maryland, will probably continue to increase in 1968 if the catch rate off Point Pleasant remains at its present level--and the demand for surf clam meats either holds firm or increases.

Although the New York surf clam fleet added one new vessel in 1967, the fishery is operating on rather limited beds off the southern shore of Long Island. Landings probably will not increase appreciably.

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- 1967b. The Atlantic surf clam fishery in 1966. U. S. Fish and Wildlife Service, Coml. Fish. Rev., vol. 29, nos. 8-9, pp. 64-67. (Also Sep. No. 797.)





BAHAMAN FISHES

"Fishes of the Bahamas and Adjacent Tropical Waters," by James E. Böhlke and Charles C. G. Chaplin, Livingstone Publishing Co., Wynnewood, Pa., 1968, 800 pp., 36 pls., 223 text figs., numerous unnumbered figs. This book is a tasteful and well-illustrated treatment of the shallow water (mostly above 100 ft.) fishfauna of the Bahamas. Although its primary aim is to facilitate the identification of Bahaman fishes, it is an invaluable source of information on many kinds of shallow water fishes from the entire tropical western Atlantic. The book, based chiefly on recent authoritative research, covers over 500 species. It includes discussions of each family, keys to genera and species, and a page of illustration and comment for each; some are illustrated in color. The references are a valuable guide to the species covered and to extra-limital forms as well.

--Daniel M. Cohen

BIOLOGICAL COLLECTING

"The Sea Brings Forth," by Jack Rudloe, Alfred A. Knopf, New York, 1968, 261 pp., illus., \$6.95. Where does a Washington, D. C., zoologist studying barnacles get his specimens, or an Ohio medical school staff engaged in cancer research find anomalous fishes with tumors? How does a Chicago biochemist procure sharks' livers for his study of trigger mechanisms of nitrogen metabolism? Scientific researchers often rely on a man like Jack Rudloe, a professional biological collector. Still only 23 years old, he has written a most entertaining account of his collecting experiences and his friends among the shrimpers and crabbers--whose nets he gleans for 'trash' creatures useful to him, but worthless to them. This is the story of a young man in business, a record of adventurous entrepreneurship and, at the same time, a most extraordinary nature book.

CARIBBEAN FISHES

"Caribbean Reef Fishes," by John E. Randall, T. F. H. Publications, Jersey City, 1968, illus., \$12.50. This is a very useful guide to fishes of the Caribbean. These are the species most likely to be observed by man in the sea, or caught by man near shore. The book contains formal accounts of 300 species, all illustrated with photographs; half are in color. Dr. Randall has directed a marine biology survey on the Virgin Islands and is a former Director of the University of Puerto Rico's Institute of Marine Biology.

BEACHES

"Beaches--their lives, legends, and lore," by Robert and Seon Manley, Chilton Book Co., Philadelphia, Pa., 1968, 383 pp., illus., \$9.50. The magic spell cast by a beach and the seashore's universal appeal have a particular significance for science and conservation today. The Manleys have painted a comprehensive picture of the geology, history, adventure, and conservation of the beaches of Hawaii, Puerto Rico, Mexico, the Pacific coast, the Atlantic seaboard, and the Gulf coast. The book is not only an unusual introduction to the coastal history of the U. S., it is also a vivid plea to conserve our beaches for the generations to come.

FRESH-WATER FISH

"A Systematic Study of the Greenside Darter, *Etheostoma blennioides* Rafinesque (Pisces: Percidea)," by Robert Victor Miller (reprinted from "Copeia," no. 1, Mar. 15, 1968), 40 pp., illus. The greenside darter inhabits many streams of the Great Lakes and Mississippi and Potomac River drainages. Differences have evolved among certain populations in those drainages. This paper describes the infraspecific variation and reviews the biology of this species.

LINE-FISHING

"Line-Fishing on the Continental Slope. II," by G. R. Forster, article, "J. Mar. Biol. Assoc. U. K.," (1968), vol. 48, no. 2, pp. 479-483. This is a report on experimental line-fishing carried out from 150 miles WSW of Scilly to about 100 miles south of Ushant, from 1964 to 1967. During 3 different cruises, 163 deep-sea fish were caught from 28 line hauls, in depths of 1,000 to 3,300 m. Slightly more than half the catch consisted of elasmobranchs; the largest individual fish was a shark (*Pseudotriakis microdon*), 2.25 m. long, taken from 1,400 m. Catches from around 3,000 m. were just as large as those from 2,000 or 1,000. Below 3,000, only teleosts were taken. The need for baited hooks to be close to the bottom was amply confirmed.

NEW SPECIES

"A New Species of Sardine (*Sardinella*, Clupeidae) from the Marquesas Islands," by Frederick H. Berry and Peter J. P. Whitehead (reprinted from "Proc. Biol. Soc., Wash.," vol. 81, 1968, pp. 209-222), Contribution No. 65, Tropical Atlantic Biological Laboratory, BCF, Miami, Fla. 33149. A sardine from the Marquesas Islands was introduced into Hawaiian waters as a bait fish in 1957 and has successfully reproduced there. The authors, finding that it lacked a valid scientific name, have described it as a new species, *Sardinella marquesensis*.

"*Centropyge eibli* n. sp. from Nicobar (Pisces, Percoidae, Pomacanthidae)," by Wolfgang Klausewitz, trans. from the German by Alexander Dragovich, 6 pp., illus., BCF Trans. No. 17, Tropical Atlantic Biological Laboratory, Miami, Fla. 33149. Among the fishes collected during the last Xarifa-Expedition in the region of Nicobar, three specimens of *Centropyge* seemed to be a new species. Finding no previous description, the author has described *Centropyge eibli* in this paper.

OCEANOGRAPHY

"National Oceanographic Data Center Highlights 1968," 20 pp., illus. Single copies available free from National Oceanographic Data Center, Washington, D. C. 20390. The mission of the Center is to "acquire, process, preserve, and disseminate unclassified oceanographic data for scientific, industrial,

and defense purposes." This booklet summarizes the Center's activities for fiscal year 1968.

"Eastropac Information Paper 8," Fishery-Oceanography Center, La Jolla, Calif., 1968. This information paper is the second of a series of working documents for those processing or interested in EASTROPAC data. It consists of station lists summarizing the observations made. It covers the period April 1967 to January 1968.

OIL POLLUTION AND
OIL-SPILL REMOVERS

"Oil from the 'Torrey Canyon'," by Angela Croome, article, "Sea Frontiers," vol. 14, no. 3, May-June 1968, pp. 138-149, illus. The wreck of the Torrey Canyon and its pollution of the beaches of southwest England and Brittany was a squalid disaster with squalid consequences. Although the gross bird mortality was due, directly or indirectly, to oil pollution; the principal damage to marine life came from detergents used to remove the oil. This was especially true along the shoreline, where the chemicals were applied indiscriminately, in heavy concentrations, and persistently. Littoral life was relatively unaffected by the oil, even on heavily contaminated beaches. There was some damage to anemones, but most molluscs were impervious; limpets and winkles continued to browse and move about on oil-contaminated rocks. The enormous quantities of detergents dispensed on the shore changed the scene dramatically. Molluscs, crustacea, rockpool fish, worms, anemones, marine algae, and other littoral flora and fauna were decimated. Many bivalves, starfish, and sea urchins died, and many of the inshore crabs still alive were without claws and legs. How serious the effect was on plankton and fish larvae is still unknown, but emulsifying chemicals rupture the membranes of their cells. Miss Croome, telling the whole sad tale, has recommended rules to be followed in any like disasters.

"Toxicity of Oil-Spill Removers ('Detergents') to Marine Life; An Assessment Using the Intertidal Barnacle *Elminius modestus*," by E. D. S. Corner, A. J. Southward, and E. C. Southward, "J. Mar. Biol. Assoc. U. K.," 1968, vol. 48, pp. 29-47. During the first few weeks following the stranding of the 'Torrey Canyon,' and the release of its cargo of crude oil, information was urgently needed on the

poisonous effect of the detergents used to emulsify the floating oil and to remove oil washed up on the rocks and sand along the coast. As evidence about a widely distributed intertidal animal would have general significance, the barnacle Elminius modestus Darwin was chosen for the experiments described in the article. Evidence was found that very low concentrations of detergent can have long-term toxic effects, inhibiting growth and normal development, and even causing death. There is also reason to suppose that some animals, encountering the detergent for only a short time before moving into uncontaminated areas, will carry with them the seeds of eventual destruction.

"Long-Term Effects of Low Concentrations of an Oil-Spill Remover ('Detergent') Studies with the Larvae of Sabellaria spinulosa," and "Temporary Adsorption on a Substrate of an Oil-Spill Remover ('Detergent'); Tests with Larvae of Sabellaria spinulosa," by Douglas P. Wilson, article, "J. Mar. Biol. Assoc. U. K.," 1968, vol. 48, pp. 177-208. The articles describe two experiments with the detergent BP 1002. Larvae immediately detected the detergent, at concentrations of 1 ppm, and were intensely irritated by it. Placed in loosely covered vessels (the solvent fraction was allowed to evaporate) larvae seemed to recover at first but died several weeks later; control larvae remained active and normal. Surfactant and stabilizer fractions at concentrations of 2.5 ppm killed the larvae within a day or two. In the second experiment, sand was soaked for 90 min. in sea water containing the detergent in concentrations of 1,000 and 100 ppm (-mg/1.) and then thoroughly washed. Larvae crawling on it soon afterwards were damaged, but the toxic effect disappeared after some days.

OYSTERS

"The Mississippi Oyster Industry," by Bruce W. Maghan, Fish and Wildlife Service, Dept. of the Interior, FL-607, Dec. 1967, 12 pp., illus. Available free from Branch of Reports, Publications Unit, 1801 N. Moore St., Arlington, Va. 22209. Mississippi coastal waters have been a source of oysters since precolonial days; the eastern oyster reaches marketable size in 2 years in Mississippi. This report describes how productive areas are maintained and how certain reefs are lost because of municipal and industrial wastes. The report includes methods and equipment used to harvest oysters, annual

landings and value, and the number of men in the fishery.

"Oyster Mortalities, with Particular Reference to Chesapeake Bay and the Atlantic Coast of North America," by Carl J. Sindermann, Fish and Wildlife Service, Dept. of the Interior, SSR-569, 1968, 10 pp., illus. Available free from Branch of Reports, Publications Unit, 1801 N. Moore St., Arlington, Va. 22209. A number of recent mass mortalities of oysters of the Middle Atlantic States, and elsewhere, have been attributed to the effects of disease. This paper summarizes recent information about mass mortalities, their effects on the American oyster, Crassostrea virginica, and industry--and offers methods of disease control.

REARING EXPERIMENTS

"Rearing Herring Larvae to Metamorphosis and Beyond," by J. H. S. Blaxter, "J. Mar. Biol. Assoc. U. K.," 1968, vol. 48, pp. 17-28. The use of natural plankton and other foods, and of transfer techniques during phases of mortality before metamorphoses, has made it possible for substantial numbers of herring larvae to be reared beyond this stage; these supply requirements for experimental work. It had been hard to prevent a steady mortality in previous rearing methods. This paper describes modifications derived from experiments during the spring herring spawning seasons in 1963, 1964, 1966, and 1967.

SALMON

"The Sockeye Salmon," by Russell E. Foerster, Fisheries Research Board of Canada, illus., C\$8.00. Available from the Queen's Printer, Ottawa, Ont., Canada. The author presents the information he has gathered during 40 years of research into the life history, propagation, and ecology of the sockeye salmon. His studies include the fishery, spawning, migrations, lake life, marine life, artificial propagation, and crossbreeding the species.

"Canada's Pacific Salmon," by Roderick Haig Brown, Department of Fisheries, Ottawa, 1967, 29 pp., illus. Available from the Queen's Printer, Ottawa, Ont., Canada, cat. no.: Fs 34-1967/1. Scientists have learned much about the movements and habits of the genus Oncorhynchus in recent years. Research and fishing experience have yielded

sufficient information to enable conservation-minded governments to ensure that the salmon's existence is not jeopardized. This is the story of the 5 species of Pacific salmon as it has emerged to the present time. It is a dramatic story that should be widely known. No other resource offers mankind so much in return for so little.

"Models of Oceanic Migrations of Pacific Salmon and Comments on Guidance Mechanisms," by William F. Royce, Lynwood S. Smith, and Allan C. Hartt, Fish and Wildlife Service, Dept. of the Interior, 1968. (Reprinted from Contribution No. 269, College of Fisheries, Univ. of Wash.) Fishery Bulletin, vol. 66, no. 3, pp. 441-62, illus. Available free from Branch of Reports, Publications Unit, 1801 N. Moore St., Arlington, Va. 22209. The return of the salmon to its home stream, to the part of the stream where its parents spawned, or even to the hatchery where it was reared as a fry, has been well documented. The appearance of the salmon in coastal waters and its final ascent of the stream are only the last acts in a most remarkable series of migrations that has been studied only recently in enough detail to permit a reasonably comprehensive description. This report constructs models of the ocean migrations of 3 typical stocks originating in diverse geographical areas: southeastern Alaska and central British Columbia pink salmon; East Kamchatka pink salmon; and Bristol Bay sockeye salmon. The models illustrate the features of the migration, the navigational problems, and the kinds of position- and direction-finding information presumed to be available to the fish.

TRANSLATIONS

"Translations on USSR Fishing Industry and Marine Resources," 1968, Clearinghouse,

U. S. Department of Commerce, Springfield, Va. 22151. A series of reports formerly sold by the Joint Publications Research Service, now available only from the Clearinghouse. Single copies \$3.00 and annual subscription \$18.00 (\$22.50 for overseas). These are translations of current articles from Soviet fishery and oceanography publications on a wide variety of subjects: species, insulation for refrigerated ships, crab processing, new commercial fishing regions, sea farms, purse seining, fishery statistics, electrical fishing devices, and industry trademarks. Write the Clearinghouse for further information.

An English edition of the Soviet journal "Voprosy Ikhtiologii" (Problems of Ichthyology) is being published by the American Fisheries Society, 1040 Washington Bldg. NW., Washington, D. C. 20005. A single issue is \$18 and an annual subscription (6 issues) \$48. Two issues are already available.

Two papers, published in 1968, by the French Office of Scientific and Technical Research Overseas (ORSTOM), translated by Salvatore DiPalma, may be borrowed from Branch of Foreign Fisheries, BCF, Dept. of the Interior, Rm. 8015, Washington, D. C. 20240. "Notes on Spanish Shrimp Fishery of the Coast of Congo and Angola" (ORSTOM doc. no. 422 S.R.), by A. Crosnier and J. J. Tanter, covers nets, species and their sizes, fishing areas and depths, yields, treatment of catch on board and marketing. "Observations on Possibilities for Development of Shrimp Fisheries on the Ivory Coast" (ORSTOM prov. scientific doc. no. 20), by J. P. Troadec, examines the biology of commercial shrimp of the continental shelf, marine and lagoon fishing, fishery abundance and profitability, and culture.

--Barbara Lundy



INTERNATIONAL

FAO Experts Assess Tuna Stocks in Atlantic & Indian Oceans

Fishery scientists from the U. S., Japan, France, and the Congo (Brazzaville) met at BCF's Tropical Atlantic Biological Laboratory (TABL), Miami, Florida, Aug. 12-16, to assess tuna stocks in the Atlantic and Indian Oceans. The meeting was sponsored by the UN's Food and Agriculture Organization (FAO).

The group considered longline and surface fisheries in the Atlantic and Indian Ocean for yellowfin tuna, albacore, bigeye tuna, the bluefin tunas, and skipjack tuna. Stock separation, catch and effort data, biological data, and status of stocks were examined. The experts found many parallels between the status of stocks in the Atlantic and Indian Oceans.

Their preliminary conclusions were:

The Atlantic

The major Atlantic tuna fisheries are the longline fisheries, chiefly for yellowfin, albacore, and bigeye, which now cover most of the tropical and temperate waters of the Atlantic; surface fisheries, mainly purse seine and live bait, for yellowfin, skipjack, and bigeye tunas along the West African coast; and trolling and live-bait fishing in the Bay of Biscay region for small albacore and bluefin tuna.

The Japanese longline fishery started in 1956 and increased continuously until 1965. Some decrease in Japanese fishing in recent years has been offset by increased fishing by longliners from South Korea and China (Taiwan). The longline fishery initially concentrated on yellowfin; later, as yellowfin abundance decreased, attention was transferred to albacore. The effort in surface fisheries also is increasing; French and Spanish vessels are being joined by vessels from the U. S., Japan, and West African countries.

State of the Stocks

The stocks of large yellowfin on which the longline fishery is based have been greatly reduced by fishing. Any additional increase in longline fishing would, at best, increase the

total longline catch only marginally--and might well decrease the total longline catch. Further, increased fishing will certainly continue to decrease the catch per unit effort.

The surface yellowfin fishery is based on smaller fish. This fishery has reduced the recruitment to the yellowfin longline fishery. The presence of the surface fishery may increase the total Atlantic yellowfin catch; it is unlikely to decrease it. However, if the minimum size of fish taken in the surface fishery is decreased, the total catch will almost certainly be decreased.

The longline albacore, and possibly bigeye stocks, also are heavily fished. Increased longline fishing would give little or no increase in albacore catches, though it may be possible to increase bigeye catches. Increased fishing will decrease the catch per unit effort, particularly for albacore. The relation between the surface and the longline fisheries for albacore in the North Atlantic is unknown.

The bluefin stocks do not appear to be large; the group of small bluefin fished off New England is small and heavily exploited.

The skipjack stock appears large; the present small catches can be increased.

Indian Ocean

The history of the longline fishery is similar to that in the Atlantic and the Pacific--increasing Japanese fishing since about 1952 and, more recently, increased fishing by China (Taiwan) and South Korea. Initially, the Japanese catches consisted mainly of yellowfin, but now contain approximately equal catches of yellowfin and bluefin, and less albacore and bigeye. The major surface fisheries are on the eastern boundaries of the Indian Ocean--for bluefin off Australia, and for yellowfin and other species around Indonesia. Another surface fishery is developing off Somalia.

The yellowfin stocks in the Indian Ocean are probably independent of those in the Atlantic. However, there is apparently some intermixing of albacore, bigeye, and bluefin around South Africa.

The state of the stocks is similar to those in the Atlantic. The stocks of all 4 species are heavily fished by the longliners. Increased longline fishing will not increase appreciably (and may decrease) the total yellowfin, bluefin, and albacore catches, though some increase in bigeye catches may be possible. Increased fishing will reduce the catch per unit effort of all 3 species. The effects of the surface fishery for bluefin on the longline fishery is not known.

The major opportunity for increasing appreciably the Indian Ocean tuna catch is with skipjack; these stocks appear large. Increased catches might result from surface fisheries of bluefin and yellowfin. (The experts lacked information to examine these possibilities.)

Need for Statistics

There is an urgent need to improve the statistics of total landings, species composition, and fishing effort. Because of the nature of the fisheries--long-range vessels and landings in foreign countries--the collection, tabulation, and publication of detailed statistics might be better done for the world as a whole, rather than for each ocean.

The Panel

Members of the FAO Working Party of Tuna Stock Assessment are: J. A. Gulland, FAO (Convenor of meeting); J. Joseph, IATTC; J. C. Dao, France; J. C. Le Guen, Congo (Brazzaville); B. Rothschild, M. B. Schaefer, J. P. Wise, U. S.; I. Yamanaka and A. Suda, Japan.

Background of FAO Study

World catches of tunas and related fishes have increased from 920 metric tons in 1948 to an estimated 1,400-1,500 metric tons in 1968. Most tuna catches are made in the tropical and temperate parts of the oceans. FAO convened the World Scientific Meeting on the Biology of Tunas and Related Species in California in 1962. A 4-volume report of this meeting was issued.

Because the tuna fisheries are carried out principally on the high seas, effective conservation regulations can be carried out only on an international basis. International organizations already deal with these matters in the Indian Ocean and the Pacific Ocean: the

Indo-Pacific Fisheries Council and the Inter-American Tropical Tuna Commission (IATTC). The IATTC is regulating tuna catches in the eastern tropical Pacific.

The Atlantic tuna fisheries began to increase dramatically in the late 1950s. Alert to the need for international study and possible control, FAO called a conference in Rio de Janeiro, Brazil, in May 1966 to begin forming a research and regulatory body for Atlantic tunas. The result was adoption of the International Convention for the Conservation of Atlantic Tunas. This convention will become effective when ratified by 7 nations. The U. S., Japan, South Africa, and Ghana have ratified it; France, Spain, and Canada are expected to ratify shortly.

Partly to facilitate attainment of the Convention's purposes, FAO early in 1968 began to set up a Working Party on Tuna Stock Assessment. Such parties are made up of experts in particular fields who meet at FAO's expense to study problems and to recommend solutions. The scientists are chosen by FAO and do not represent their nations or governments. They draft a report, which FAO submits to its members.



Norway Stops Danish and Swedish Fishing in 12-Mile Limit

The Norwegian Government has decided to terminate Danish and Swedish fishing in the 12-mile limit, west and north of Norway's southernmost point, no later than Oct. 31, 1970. Shrimp fisheries of Denmark and Sweden will be affected most. Norwegian fishing in the 12-mile limit off Denmark's west coast also will be terminated.

Other Agreement Continues

The special agreement permitting the 3 countries to fish up to a line 4 miles from the coastwise baselines in the Skagerrak and Kattegat, east and north of the southernmost point of Norway, will be continued. (Asst. Reg. Fisheries Attaché, U. S. Embassy, Copenhagen.)



EFTA Keeps Trade Restrictions

At its last meeting, the Council of Ministers of the European Free Trade Area (EFTA) agreed to explore possible trade expansion among member countries. Willingness of EFTA countries to act on this recommendation was tested in June, when a working group in Geneva discussed trade in fish and fishery products. The group concluded that removal of restrictions on fishery commodities was not possible. A completely negative report was submitted to the EFTA Council. (Asst. Reg. Fisheries Attaché, U. S. Embassy, Copenhagen.)



EEC Common Fisheries Policy Delayed

The EEC Common Fisheries Policy did not take effect on July 1 as originally planned. Probably several months or a year will elapse before the policy is effected. Common Market imports of some agricultural commodities have almost ceased as a result of the protectionist nature of the common EEC agricultural policy. Such effects are not likely to result from the fisheries policy, because EEC countries will continue to require large quantities of fish products from nonmember countries. (U. S. Embassy, Copenhagen.)



USSR & Pakistan Sign Fisheries Aid Agreement

A USSR-Pakistan 2-year fisheries aid agreement was signed in Moscow during the summer. Under the agreement, the USSR will help Pakistan study fishery resources off her coasts, train fishery specialists, and, if requested, draft a feasibility study for construction of a new fishing port on the Arabian Sea coast. The Soviets will also send 3 fishery research vessels to explore local fishery resources and Pakistani fishery scientists will participate. (TASS.)

Wants New Resources

Pakistan claims that Arabian Sea coastal fishery resources are overfished and wants new ones found 10-30 miles offshore. The

Bay of Bengal area is being explored by an FAO-sponsored team of fishery scientists, including 2 biologists from the Soviet research institute ATLANTNIRO.



Netherlands Sends Shrimp Trawlers to Persian Gulf

A new shrimp trawler, catcher, and processing factory in a hull less than 90 feet long has sailed from the Netherlands to Dubai on the Persian Gulf. The vessel, "Alibut I," a twin-boomed, double-rigged trawler, has enough cleaning and freezing equipment to produce daily 4-6 metric tons of unshelled, heads-off shrimp.

She will work with a catcher vessel off-loading shrimp for the U. S. market to refrigerated transports at sea. Owner is Gulf Marine & Diving Co. Ltd. ("Fishing News International.")



Symposium on Ocean Bottom Held in Stockholm

An International Institute for Peace and Conflict Research (SIRPI) symposium on the ocean bottom was held in Stockholm, June 10-14. Seven countries, including the U. S., sent delegates. The agenda included acquisition of mineral resources, acquisition and control of marine fishery resources, military uses of the continental shelf and the seabed beyond, and scientific research in the oceans.

Symposium Recommendations

The Symposium recommended that no government should claim more than a 12-mile territorial sea, and that early consideration be given to establishing an intergovernmental ocean organization. (U. S. Embassy, Stockholm.)



USSR to Aid Algerian Fisheries

Algeria has concluded a Technical Assistance Agreement with the Soviet Union to develop Algerian industry. Fisheries will be one of the 12 industries to receive Soviet aid.

Technical Assistance

According to the Algiers newspaper, "El Moudjahid," the 3 phase Agreement will last for several years. Between 1968 and 1972, the Soviets will make "commercial offers" of exploratory research vessels and fishing trawlers to Algeria. Later, feasibility studies will be made on fishing port improvement, loading and unloading facilities, production improvement, and establishment of fish inspection. Finally, the Soviets will train Algerian fishery specialists.

Other Aid Agreements

The Agreement is similar to others the USSR has concluded with developing countries, but its provisions are more extensive. Other assistance to Algerian fisheries came in 1965-early 1966 when Yugoslavia built 5 fishing vessels for the Ministry of Economic Development. Purchases were financed with Yugoslav credits granted to Algeria. In 1963, the Bulgarian Communist Party stated that "Bulgarian fishery experts will go to Algeria, . . . and other Mediterranean countries to study marine fishery resources. . . and to conclude agreements for entry into their ports." Apparently this plan never materialized.

Algerian Landings

Algeria needs to develop her fishing industry. In 1966, landings were 20,300 metric tons, mostly pilchards; 10 years before, landings were 22,300 tons. At the same time Morocco, Algeria's neighbor on the Atlantic, had increased her catches from 112,000 metric tons in 1956 to 303,000 in 1966.



Indian Ocean Yellowfin Catch Declined

In early September, yellowfin tuna catches in the western Indian Ocean north of Malagasy declined to an average 2.5-2.8 tons per vessel per day. From October 1967 until this summer, fishing was excellent and vessels were averaging 5-6 tons a day. At present about 30 Japanese long-liners and 60 other foreign tuna vessels are fishing in the western Indian Ocean. ("Suisan Tsushin," Sept. 7.)



Mauritanian Fisheries Director Visits Japan

The Bottomfish Trawlers Association invited the Mauritanian Fisheries Director to visit Japan in late August or early September. The invitation was extended to promote friendship and goodwill and to provide an opportunity for informal discussion of an agreement permitting the Japanese to trawl inside Mauritania's 12-mile exclusive fishery zone.

Terms of Possible Agreement

The Association sent a mission to Mauritania in July 1967 to discuss a possible agreement. At that time Mauritanian officials agreed to permit Japanese fishing, if the Japanese would train Mauritanian crews, build and operate cold storages, assist in building vessel and gear repair facilities, and provide fishery consultants. Some Japanese question the merit of investing in Mauritanian fisheries in exchange for the right to fish for species like octopus and squid, which are marketable only in Japan, Italy, and Spain. ("Suisancho Nippo," Aug. 12.)





Nova Scotian youngster packs salt herring for export. Fish are pickled in tubs of brine. (Photo: National Film Board)

FOREIGN

CANADA

ONTARIO PRODUCES MORE FISH

Ontario commercial fishermen landed 12.8 million pounds of fish during the first 4 months of 1968, about 7.5% greater than for the same period last year, according to preliminary figures released by the Department of Lands and Forests. This increase came from the northern inland waters and all the Great Lakes, except Georgian Bay and Lake Huron.

The fishermen's revenue was nearly C\$1.2 million. It increased correspondingly with the fishing area despite the reduced catches in Lake Huron. Lake Erie, where nearly five-sixths of the fish were landed, was a notable exception. There, catch value declined in spite of a 4.5-percent increase in landings. The entire provincial catch value is down 3.5% because of the Lake Erie decrease.

The fishing industry requested a closed season and quotas on Lake Erie yellow perch to avoid oversupply. This reduced yellow perch landings to 1 million pounds. A spring price of 7 cents a pound, compared with 10 cents a pound last year, also reduced Lake Erie catch value. (Ontario "Newsletter.")

BRITISH COLUMBIA SALMON CATCHES

Record sockeye salmon runs in Rivers and Smith Inlets in British Columbia, and good catches of pink, chum, and coho have resulted in a C\$24.5 million fish landing value for the July period, nearly C\$7 million more than the previous July high of C\$17.6 million in 1966. Salmon landings were worth C\$22.9 million ex-vessel, halibut C\$1.2 million, and other fish, including shellfish, C\$400,000.

A total of 79 million pounds of salmon were landed; 34 million pounds of net-caught sockeye valued at C\$12.8 million; nearly 20 million pounds of net-caught pinks worth C\$2.5 million to fishermen; trollers landed 7.8 million pounds of dressed coho, valued at just over C\$3 million.

Chum salmon landings, mainly from northern areas, were 7.8 million pounds worth just

under C\$1 million; the highest landings and value of chums for July since 1955.

Seiners and gill-netters landed 7.5 million pink salmon, but they were exceptionally small, averaging only 2.6 pounds, compared to a normal July average of about 4.4 pounds. Troll-caught spring salmon amounted to 2.7 million pounds worth C\$1.6 million, compared with 2.5 million pounds and C\$1.4 million in July 1967.

Net-caught spring salmon landings were down, totaling 1.6 million pounds, compared with 2.2 million pounds a year ago.

Halibut landings during July (including deliveries at U. S. ports by B. C. fishermen) were 5.1 million pounds as against 7.0 million pounds in 1967. ("Fisheries News," Canadian Dept. of Fisheries, Aug. 23.)

DOGFISH DIET FOR BLACK COD

The lowly dogfish, scorned as a nuisance in fishermen's nets and rejected as a food fish, may become part of the Canadian diet. The sharklike fish may be used as food for Alaska black cod, a gourmet species that can be raised in captivity.

Black Cod Adaptable

The Nanaimo Fisheries Biological Station has found that black cod, completely adaptable to pond cultivation, thrives on a diet of ground-up dogfish. The dogfish diet imparts a superb flavor to the cod. Other foods have been tried, but dogfish has proved the best. Black cod eats more voraciously and grows more rapidly when in captivity. It is an ideal subject for farming.

Dogfish Use Welcomed

There is a long way to go before cod ponds can be established, but a fish-farming program could be developed. Nanaimo scientists have determined that an Alaska cod can consume up to 5 pounds of dogfish for each pound it gains; in early growth stages it converts a pound of dogfish into a pound of cod. As the dogfish has little or no commercial value, any effort to use and control it would be welcomed. (Canadian Dept. of Fisheries, Oct. 4.)





The day's salmon catch is weighed prior to bidding at St. Jean de Luz, France. (Photo: International Labour Office)

EUROPE

USSR

FISHERIES MINISTRY TO SELL SEAFOOD IN MOSCOW

The Fisheries Ministry will take over the sale of fishery products in Moscow on an experimental basis. The Ministry will supply retail food stores and markets with fish and fishery products. Transportation facilities will be provided by the City Administration.

Cold-Storage Facilities

The Moscow Fisheries Combine, the Moscow Harbor Cold Storage Plant, and several other cold-storage facilities in Moscow, formerly under the Ministry of Trade of the Russian Republic (RSFSR), will be turned over to the Federal Fisheries Ministry.

Activities of New Unit

A new unit, MOSRYBA, has been created to supervise and coordinate the operation. MOSRYBA will organize a continuous supply of high-quality fishery products; sell to markets and retail stores; assist retailers in promoting sales and try to increase consumer demand. ("Ekonomicheeskaya Gazeta," March 1968; "Rybnoe Khoziaistvo," Nov. 3.)

CAVIAR SHORTAGE

A caviar shortage, caused by low catches of Volga sturgeon, was reported by the Associated Press from Moscow. Because of hydroelectric power dams on the Volga, increasing pollution, and overfishing, it is feared that Caspian sturgeon stocks are becoming extinct. A Fisheries Ministry official, V. S. Maliutin, has called for restoration of sturgeon "to its former glory." ("Japan Times," July 16.)

Exports

The caviar export trade suffered a reverse in 1963-64 when stocks sold to Western Europe were returned because of an off-odor, apparently caused by polluted waters. In 1966 only 699 metric tons were exported, worth US\$2.9 million, but in 1967 exports increased 28%, to 900 tons worth US\$5.1 million.

It is possible that the reported domestic shortage was caused by increased exports.

Catches Are Declining

What really worries Soviet fishery officials, however, are smaller catches of sturgeon indicating decreasing stocks. During 1958-62, the Volga sturgeon catch was about 50-60% of the world's catch. In 1962, the Soviet sturgeon catch was 22,100 metric tons. Catch has decreased each succeeding year until in 1966 it sank to 15,100 tons. Hatcheries producing 50 million fingerlings a year have been set up on the Volga and Kura rivers. The Ministry of Fisheries, however, believes that 70 million fingerlings each year will be needed to reestablish stocks.

FAILS TO PROVIDE CARRIERS AND PROCESSING VESSELS FOR HER FAR EAST FISHERIES

Fishermen from Kamchatka Peninsula, who overfulfilled the catch plan for first-half 1968, had serious trouble with the Far-eastern Fisheries Administration ("Dal'ryba") this past summer. The agency had not supplied the necessary refrigerated fish carriers and processing vessels.

Eighteen trawlers in the Sea of Okhotsk were drift-netting for herring; daily catches ranged 600-700 metric tons. Despite promises from "Dal'ryba," no refrigerated fish carriers or factory vessels arrived to offload them. The catches remained for days aboard the trawlers.

20 Seiners Await Carriers

In the Gulf of Anadyr, western Bering Sea, 20 seiners were laid up because no carriers or factory vessels came to offload. The seiners caught an average 250 tons of cod daily; this could have been increased to 400 had motherships been available. A similar situation existed off Karagin Island and Cape Olyutorskii.

The planned July Kamchatka 31,500-ton catch would not be fulfilled if "Dal'ryba" failed to provide transport and processing vessels. ("Vodnyi Transport.")

USSR (Contd.):

FISHERY PROBLEMS IN THE SOUTHEAST ATLANTIC

Black Sea Fisheries Administration fishermen in the southeast Atlantic have 3 major problems:

Exploratory Fishing

Medium trawlers cruise in the fishing area, make sample trawlings, study hydrology, etc., but fail to direct the fleet to fish schools as soon as they are discovered. Moreover, medium trawlers are not equipped to explore at 1,200-1,500 foot depths where fish suitable for filleting are often found. To be of use to the large vessels working in the southeast Atlantic, exploring should be done by large freezer stern trawlers of the "Tropik" or "Atlantik" classes.

Transport and Transshipment

Catch-loaded vessels are frequently forced into demurrage for several days because of a severe shortage of refrigerated fish carriers. Transshipment to fish carriers is badly organized. Trawlers often unload only part of their holds to one carrier, an inefficient practice that causes a considerable loss of time and money.

Transshipment is much too slow because fish meal is transhipped to Merchant Marine Ministry tankers unequipped for this kind of operation on the high seas. Furthermore, vessels lose hours, and sometimes days, traveling to and from tankers located outside the fishing area.

Profits and Catch Quotas

Quality matters more than quantity. Fewer tons of high-quality fish are more profitable than more tons of low-grade fish. Despite this, all fishing vessels, including those operating under the new system, hang on to the old catch quota as a prime productivity index. Every day they must decide whether to fish for valuable food fish (hake, for instance) and jeopardize catch quotas, or take unutilized fish (such as horse mackerel, or trash fish suitable at best for fish meal) and overfulfil the quota. The problem is tough, because consumers do not want the presently unutilized fish that will make up the catch

quota. ("Ekonomicheskaja Gazeta," No. 32, Aug. 1968.)

* * *

TRAWLERS FISH OFF NORTHWEST AFRICA

The Soviet factory stern trawler BMRT-355, "Maiakovskii" class, 3,170 gross tons, fished off northwest Africa, on the Cape Verde Plateau, between 19°15' and 19°51' N., in mid-1968. This new fishing area for the Soviets, a shelf divided by 5 canyons, is hard to trawl.

Method

The trawl was set on sandy bottom at depths ranging from 110 to 200 meters (361-656 feet), at one end of a small shelf terrace. It takes 5 to 7 minutes to cross the terrace at full speed. The trawl is hoisted at the other end, where the terrace drops off into a canyon.

Catch

The trawler fished for snapper and hake. Average hauls were 1.5 to 4 metric tons. Average daily catch was 35-45 tons, after 18 to 20 hauls. BMRT-355 caught 2,000 tons of fish in about 2 months, for a net profit of 182,000 rubles (US\$200,000). ("Rybnoe Khoziaistvo".)

* * *

EXPANDS FISHERIES OFF SIBERIA

The only area of the Arctic Ocean fished commercially by Soviet vessels is the Barents Sea. Murmansk, one of the largest centers of the fishing industry, is there. Fishery resources of other waters off the Siberian coast, the Kara, Laptev and East Siberian Sea, are unutilized and unexplored. This is true also of the estuaries of the great Siberian rivers (Ob, Lena, Yenisey, Khatanga, Kolyma, etc.) more populated than the icy expanses of the Siberian seaboard.

Research Urged

Soviet ichthyologists are being urged to locate and delineate the fishery resources and study the species in those waters. Coastal areas of the Laptev Sea are believed to have commercial concentrations of fish.

USSR (Contd.):

Future Expansion

It is presently impractical to expand commercial fishing fleets in the Arctic Ocean because of water conditions and because known fish schools are too small to have commercial value. However, Siberian fisheries can be expanded by setting up shore centers provided with small supply vessels, 5 or 6 airplanes and helicopters, and gear and processing plants. A well-organized fishing industry in the Siberian Arctic might yield large amounts of valuable fish for the consumer market. ("Rybnoe Khoziaistvo.")

* * *

EXPANDS FISHERIES IN BAY OF BENGAL

The Far-Eastern Fisheries Administration is planning to expand operations in the Indian Ocean. The freezer trawler "Akustik," on an exploratory cruise in the Bay of Bengal off the Andaman Islands, will be joined by the trawlers "Astronom," "Aviator," and "Koritsa." This is the first exploration by Soviet Far-Eastern fishermen in the Bay of Bengal.

* * *

PURSE SEINER MAKES RECORD CATCH

The RS-300 class seiner, "Kosmonavt Komarov," has caught 14,480 metric tons of fish in 2½ years, Jan. 1966-June 1968. This is more than 10% above 13,000-ton catch quota assigned to RS-300 class for entire 5-Year Plan, 1966-1970.

For second time in 2 years, Kosmonavt Komarov established an annual record. In 1966, she set an official All-Union record with 5,634 tons; in 1967, her annual catch exceeded the previous record by 166 tons.

* * *

A HISTORY OF PURSE SEINING

The Soviets first attempted purse seining in the 1920s and early 1930s off the Murmansk coast, in the Black Sea, and in the far eastern waters. Results were poor, so the gear was discontinued and the seiners used to carry freight.

Improved net design, and adoption of a Japanese-designed seine-hauling machine, revived Pacific purse seining in the late 1930s. Most purse seining was done from "Kabasaki," the 13-14 meter (42.6-45.9 foot) long motorboats used in coastal fishing, with 500 meter (1,640 ft.) seines.

After World War II

Shortly after World War II, a Soviet-designed 300-horsepower seiner was adopted in the Far East, on the Black Sea, and along the Murmansk coast. The RS-300 seiners developed from those a few years later still yield excellent results purse seining for herring, and trawling for demersal fish in the Soviet Far East. Catches average 1,000 metric tons for a few months of seasonal fishing. Aerial reconnaissance for spotting commercial concentrations of fish has increased the Pacific seiner fleet's effectiveness.

Current Plans

In 1967, the Sakhalin Administration equipped 6 "Okean" class medium side trawlers for purse seining. Six medium trawlers and 5 RS-300 seiners, using 1,200-meter (3,936-foot) seines, fishing mackerel off Hokkaido, caught 9,000 tons in 2 months. In 1968, plans of the Far Eastern Administration call for equipping another 40 medium trawlers to purse seine mackerel and jack mackerel.

Purse seining developed in the European USSR on a large scale in 1966. The Murmansk fisheries also used RS-300 class seiners and converted "Okean" class medium trawlers. From June to December 1966, 15 "Okean" class trawlers purse seined herring in the Norwegian Sea; catches ranged from 1,000 to 1,800 tons per vessel. In 1967, 43 medium trawlers of the Northern and Western Administrations purse-seined in the Norwegian and North Seas; catch was about 100,000 tons. These Administrations are converting 80 more vessels to purse seining, mostly "Okean," "Maiak," and RS-300 classes.

* * *

WATER POLLUTION CONFERENCE

The first All-Union Conference on Water Pollution, attended by 400 scientists and specialists, was held at Moscow University in February. A meeting will be held every 4

USSR (Contd.):

years. Soviet scientists believe that water pollution is inhibiting industrial and city growth and that clean water shortage is increasing catastrophically.

Subjects Presented

The "keynote" paper covered the pollution rate of inland fishery water bodies, the most effective means of protection against it, and gave the maximum permissible concentrations of toxic substances tolerated by fish eggs, larvae, fry and adult fish, on which to base regulation of industrial sewage, wastes from timber rafting, etc.

Other papers described the effect of organic phosphorus and its compounds, metal-organic compounds and polymetallic ores on fish, invertebrates, and algae; the effect of phenols on certain functions in fish, and on the photosynthesis of *CHLORELLA*; and the pollution of rivers, reservoirs, and inland seas. Principal pollutants of inland waters were defined as oil and oil products; industrial, urban and rural sewage; poisonous chemicals; detergents; and timber wastes.

Conclusion

The participants deplored the increasing pollution of fresh and ocean water, urged expanded research on the effect of pesticides, detergents, and other poisonous chemicals on hydrobiological processes and on water living organisms, and recommended measures to prevent water pollution such as breeding detoxicating organisms. ("Gidrobiologicheskii Zhurnal," No. 4.)

* * *

RAILROAD CAR TRANSPORTS
LIVE FRESH-WATER FISH

The Soviets have designed a railroad car to transport live fresh-water fish over long distances. The all-metal car is divided into 3 sections. One contains 2 diesel generators and the refrigerating equipment. One is a service compartment, with a kitchen and showers, to give the service personnel maximum comfort on the trip. The third carries 2 stainless steel tanks with a capacity of 15 cubic meters.

Water in the tanks is circulated constantly and oxygen is supplied by a multijet pump. The tanks hold about 10 metric tons of fish. ("Rybnoe Khoziaistvo.")

* * *

TESTS PRESERVATION BY RADIATION

Equipment for processing fish and fish products with gamma rays will be tested on board the research vessel "Akademik Knipovich" and in a Ventspils plant, according to "Fiskaren," a Norwegian periodical. (Asst. Reg. Fish. Attaché, U. S. Embassy, Copenhagen, Sept. 17.)

* * *

WAY DEVELOPED TO WARN FISH
OF UNDERWATER EXPLOSIONS

Deep seismic soundings on the ocean floor--widely used in underwater geological exploration and surveying--may be harmful to the fishing industry because the explosions kill many fish.

Recorded Voices

Soviet biologists have developed a way to warn the fish when an explosion is imminent. A loudspeaker, lowered into the water, transmits "voices" of predator fishes recorded on magnetic tape. The fish immediately flee, and the explosion can take place without damaging marine life. The device has been tested successfully. ("Rybnoe Khoziaistvo," July.)



East Germany

WINS SECOND PLACE IN WORLD
FISHING VESSEL CONSTRUCTION

In 1967, East Germany ranked second in the world in fishing vessel construction. Her shipyards built 82 fishing vessels, 103,311 gross registered tons--19.6% of total world construction; Japan built 21.8%. ("Neues Deutschland" July 29.)

In first-half 1968, East Germany launched fishing vessels totaling 42,000 gross registered tons. Twenty-seven were exported to the Soviet Union, France, Norway, West Germany, and Denmark.

East Germany (Contd.):

Rated Third by Soviets

A Soviet source has rated East Germany third, with only 14% of the total. ("Vodnyi Transport.") The discrepancy may be due to incomplete data for 1967.

Plans Data Center

An electronic data center and data-retrieval system on worldwide shipbuilding developments should be completed by January 1969 for the East German shipbuilding industry. Every 4 weeks the center will issue a review of the latest developments in the industry to about 2,000 shipbuilding specialists. This must be considered an attempt by East Germany to become more competitive in selling vessels abroad. ("Ostsee-Zeitung," July 24.)



West Germany

FISHES OFF CANADA

As their herring catches in the North Sea declined, West German vessels began fishing off the Atlantic coast of Canada early in June. The vessels are supplied from the island port of St. Pierre off Newfoundland. Salted herring and frozen fish blocks will be transhipped from there to West Germany. (Fishes Council of Canada.)

PLANS UNDERWATER LABORATORY

By May 1969, the first German underwater laboratory will be lowered into the North Sea off the island of Helgoland. After tests at about 60 feet, it will be lowered about 135 feet to the bottom. The program, designed by the German agency for air and space research, will include marine-biological and medical studies. The latter will attempt to determine how heart and blood circulation react to physical work, both in and outside the pressure chamber, and to long periods in cold water. Other studies will be made on the foods best tolerated by aquanauts. ("Vestkysten," July 10.)

TRANSSHIPS SALTED HERRING FROM ST. PIERRE

The first shipment of West German-caught salted herring from the northwest Atlantic arrived at Bremerhaven in July aboard the Dutch freezer-transport "Arctic." Four Bremerhaven herring luggers had caught the fish. The luggers, reporting continued good fishing, took some of the much-sought "full" herring and, by July 25, had landed about 4,500 metric tons at St. Pierre. (U. S. Embassy, Copenhagen, Sept. 20.)



Denmark

FISHING PORT CELEBRATES FIRST BIRTHDAY

The Danish North Sea fishing port of Hanstholm celebrated its first birthday on Sept. 8. The construction of the port was begun in 1960. Ever since 1917 other efforts to build a lasting harbor had been unsuccessful.



Drying plaice, a very valuable fish, in Denmark. Many are sold live in fish shops.

Landings

In the first year, 22,000 metric tons of fish were landed at Hanstholm. Nearly 75% were industrial fish for meal and oil production; the rest were food fish. Industrial landings brought 3 million kroner (US\$400,000); food fish landings yielded about 8 million kroner (\$1.1 million).

Denmark (Contd.):

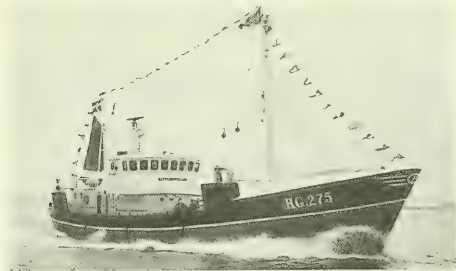
Cutters Land 90%

About 90% of the landings came from cutters home ported at other places in Denmark, showing Hanstholm's excellent location in relation to major North Sea Danish fishing grounds. If Hanstholm's own fleet continues to increase as it has during this first year, within five years it will number 100 cutters, (Asst. Reg. Fish. Attaché, U. S. Embassy, Copenhagen, Sept. 20.)

* * *

LARGEST SIDE-TRAWLER BUILT

M/S "Ellen Pedersen," the largest Danish-built side trawler, is 115 feet (overall length) and 203 gross tons. Lines and stability curve of the US\$279,000 vessel were determined by computer at the Danish Ship Technical Research Institute. It can be diverted to line and purse-seine fishing.



M/S Ellen Pedersen, largest Danish-built side trawler. First Danish vessel equipped with refrigerated sea-water cooling system.

Seawater Cooling System

It is the first side trawler in Denmark equipped with a refrigerated sea-water tank cooling system. The stern loading room can take herring and mackerel in seawater cooled to -1°C . (30.2°F .). This system saves work on board, and gives better room capacity use than ice cooling in wooden boxes. There are two storerooms with a total space of 8,500 cubic feet. (U. S. Embassy, Copenhagen, Aug. 9.)

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FISHING SALMON OFF GREENLAND

Although the State's Ship Inspection Control office considered the vessels unsuitable for the hazardous trip across the North Atlantic, about 20 small Danish fish cutters, some only 20 GRT, fished salmon off Greenland this year.

10 Cutters in 1967

Greenland salmon fishing disappointed the 10 cutters making the trip last year; stormy weather interfered with fishing. Nevertheless, this year twice as many cutters were willing to risk everything for the chance of making a profitable catch. Danish interest was aroused when, in 1966, a Faroese line vessel caught US\$200,000 worth of salmon in 3 months. (U. S. Embassy, Sept. 3.)

* * *

FISHES YOUNG HERRING IN NORTH SEA

In recent years, many small boats from the Esbjerg industrial fishing fleet have fished young herring from nearby North Sea grounds. Other countries have often criticized this fishery because of its impact on abundance of adult herring in subsequent years. The North East Atlantic Fisheries Commission (NEAFC) has discussed the desirability of protecting these young herring but has taken no action. The Danes have been told that fishing young herring definitely has an effect on late fishing of adult herring elsewhere in the North Sea, including waters off the Scottish and English coasts.

Declining Stocks

North Sea herring fishing has become more dependent on strong year-classes because the stock in the southern North Sea has been drastically reduced by ten years of intensive fishing. In the 1950's, about 200,000 metric tons were taken annually; only 5,000 tons had been taken by October this year. Criticism of the Danish small herring fishery will intensify because the year-class being fished appears strong and others will object to this heavy fishing of juvenile stages.

Criticism of Fishery

Critics emphasize two points: (1) Danish fishermen damage subsequent years' fishing--in which they themselves participate--

Denmark (Contd.):

and, (2) reduction plants do not want small fish; they are difficult to process and meal and oil yield is poor.

Needs Tagging Study

NEAFC action to protect young herring has been postponed pending further study. An extensive tagging effort is essential to determine racial composition and mortality rate of stock fished on Bloden Ground. In May 1968, the NEAFC decided that the study could not begin before fall of 1969, and would be contingent on more financial support from member countries. (U. S. Embassy, Copenhagen, Sept. 17.)

* * *

SETS MINIMUM PRICES
FOR HERRING EXPORTS

Minimum prices have been instituted for whole and cut herring exported to Common Market (European Economic Community, EEC) countries. The agreement, worked out primarily between Denmark and West Germany, was reached quickly because both needed it. Denmark wanted substantially higher prices than those prevailing, while Germany wanted to avoid sales of Danish herring at "dumping" prices. Denmark was motivated, in part, by fears that Germany would request an end to the EEC customs-free quota, if low prices on Danish herring exports continued. Minimum price systems are already in effect for some Danish pond trout and fresh cod fillets exports to other European countries.

EEC Common Fisheries Policy

Because the EEC is Denmark's best customer for fish and fish products, they are extremely interested in avoiding any disruption of the market while the EEC Common Fisheries Policy is under preparation. This policy has been delayed pending agreement on territorial fishing rights. It is doubtful that agreement will be reached on these, although the rest of the policy probably will be approved. (U. S. Embassy, Copenhagen, Sept. 20.)

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REGULATES SALES OF
PACKAGED FRESH FISH

The growing supermarket trade in retail-packaged fresh fish in closed packages has led to a new regulation. It covers whole fish, fillets, boned herring, crustaceans, fish roe, and fish liver.

Provisions

General provisions cover quality of the raw material, processing and packaging material. Packages must be clearly marked to indicate: (1) the type of commodity, (2) net weight, (3) registration number of the producer, (4) packing date and latest sales date (not in code), and (5) the highest permissible refrigeration temperature, 5° C. (41° F.). The most noteworthy provision is that packaged fresh fish must be sold by the retail shop before close of business on the day after packaging. Eel and flatfish, whole and in pieces, may be sold no later than the second day after packing. Fresh fish can be sold only in established retail fish shops; however, special permission for sale can be obtained by supermarkets meeting hygienic requirements.

Top Quality Assured

Denmark, surrounded by productive fishing grounds, has no point more than 80 miles from the coast. Excellent quality fresh fish have been available to housewives in several hundred neighborhood fish shops. Supermarkets are taking a greater share of this trade each year, largely with retail packaged items. New regulation assures that traditionally high quality fishery products will continue to be available. (U. S. Embassy, Copenhagen, Sept. 20.)

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FAROESE FISH OFF GREENLAND

A large Faroese fishing fleet of 42 distant-water long-liners, 10 trawlers, and about 100 open motorboats was fishing near Greenland early in July. Long-liners and trawlers fished cod banks off the west coast, while open boats with 4 or 5 men fished inshore. The small boats were transported in special "expedition ships" and fished from Faeringehavn, Kangarssuk, Borgshavn, and Ravns Storø.

Denmark (Contd.):

The Faroese

The total population of the Faroe Islands is less than 40,000, but the islands are well represented each year in the large commercial fleet. The Faroese were pioneers in the area. They began fishing the grounds with very small cutters in the early 1920's. Their present distant-water fleet is one of the most modern.

Products

Primary products of Faroese distant-water fisheries are salt fish and klipfish, which are exported to Brazil and southern Europe. Quantities of frozen fillets produced for the U. S. market are transported directly to Boston on specially equipped refrigeration vessels.

Principal Port

Main base is Faeringehavn in the Godthaab district. The port is open to all vessels. It provides all supplies, including fuel, food, and fishing gear. It has a small hospital, radio-telegraph center, a Faroese seaman's hotel, and a Norwegian welfare home.

This season, for the first time, Greenlanders will be permitted to land catches in Faeringehavn.

Fillet Factory

The Faeringehavn fillet factory produced 3,000 metric tons of cod fillets in 1967. Its capacity has been expanded. (Asst. Reg. Fisheries Attache', U. S. Embassy, Copenhagen, July 5.)



Spain

THE FISH CANNING INDUSTRY

Spain's fish canning industry consists of 508 very small plants each producing an average of 175 to 2,000 metric tons a year. The canneries are spread among the provinces of Galicia, Guipuzcoa, Viscaya, Santander, Asturias, Lugo, Coruna, Pontevedra, Huelva, Cadiz, and the Canary Islands. The

largest and best equipped are in Pontevedra Province, which has the greatest variety of raw fish, but the industry center is in Galicia.

Production Problems

National fish canning capacity is probably 220,500 tons a year, but only 33% is utilized. Production is low (1) because canneries are too small, (2) equipment is antiquated, (3) labor is unstable and costly, (4) high price of oil used in canning, (5) low priced tin for can manufacturing is insufficient, (6) varnish to coat inside of cans is expensive, (7) raw material supply is a problem, (8) production-line techniques required to satisfy demand for high quality pack are lacking, and (9) there are tariffs and other charges on Spanish products in international market.

Industry's Future

Badly needed is a program of mergers, closures of small inefficient plants, and upgrading of existing plants, equipment, and methods. Cold-storage plants to even out the flow of raw material are required; so too is an intensive program to market finished products. It will take a revolution in thinking by industry leaders to accomplish this. ("Informacion Conservera.")



Netherlands

FISH INSPECTION

Mandatory fish inspection is carried out by the Inspection Service for Consumer Articles through all stages of distribution. The program does not apply to Surinam and Netherlands Antilles.

Local & Export Fish Checked

The inspection program applies to both export and domestic fish trade. Canned and smoked fish are laboratory tested. Inspections take place at wholesalers, at retailers, at processing plants, and at fish auctions at the border in case of imports. After compulsory sale at the auction, the fish are no longer subject to inspection controls if transported by train, boat or truck. (U. S. Embassy, the Hague.)



Italy

REJECTS JAPANESE FROZEN TUNA

Some Japanese frozen tuna shipments to Italy have been rejected because of poor quality and improper size. Italian buyers claimed the tuna were not fresh, had freezer burns, and were not properly headed and gutted. They also complained that the fish were larger than the size contracted.

Increasing Rejections

Growing competition on the Italian canned tuna market and consequent demand for better-quality pack are causing increasing rejections. Italian processors claim that, after cooking, the tuna develops green or dark meat, sponginess, putty-like condition, and petroleum odor.

Prices Affected

Due partly to the Italian buyers' stringent delivery requirements, prices of Japanese frozen tuna exports to Italy have been rising. ("Katsuo-maguro Tsushin.")



Norway

HIGH-PROTEIN FISH MEAL PLANT IN OPERATION

A/S Norod, Egersund, Norway, started production of high-protein, low-fat fish meal, this year. The plant, equipped with West German machinery, uses a conventional gasoline extraction of fat. A gasoline explosion shortly after the opening of the plant disrupted operations until a few weeks ago.

Plant at $\frac{3}{4}$ Capacity

In August the plant was operating at three-quarters of its 15,000-ton annual capacity, but was expected to run at full capacity shortly. Fat extraction of fish meal (mackerel) produces protein and fat contents of 80.2% and 0.7%, respectively. Extraction based on fresh raw materials, however, promises an 84% protein content and only 0.2% fat content. (U. S. Embassy, Oslo, Aug. 6.)

MECHANICAL FEEDER STACKS SARDINES

Trio Maskinindustri in Stavanger, Norway, has developed a new type of mechanical feeder to stack sardines. Small pneumatic fingers can pack about 40 cans a minute. A vibrator turns all the fish heads in the same direction. The feeder is equipped with a double conveyor system, synchronized by an electropneumatic device, to assure uninterrupted delivery to the processing machinery.

U. S. Plant Using Feeder

A Trio feeder, combined with a head-cutter and nobbing machine, at a Maine (U. S.) cannery, has an 18,000 fish per hour capacity, equal to the production capacity of 4 or 5 human workers. Equipped with a belly-direction device, the feeder can be combined with filleting or packing machines.

Other Developments

Trio also has developed grading machines for brisling and sardines, and large herring and mackerel. One, grading fish by weight, can handle 18,000 fish an hour. (Export Council of Norway, Oct.)

PLANS MORE FACTORY TRAWLERS

Norway is expected to build more factory stern trawlers to satisfy the growing demand for kitchen-ready fish products. Norway has five such vessels. An additional factory stern trawler, now on order, will be the first to operate out of northern Norway. There is no difficulty crewing the new factory vessels, even though trips last several months. (U. S. Embassy, Copenhagen, Sept. 20.)

EQUIPS HERRING FACTORYSHIP

The 193-foot "Triplex," a converted trawler purchased in Holland, successfully completed sea trials during the summer and is now fishing. The vessel is equipped to purse seine herring and process them into fish meal. She carries freezing tanks for herring intended for human consumption and has 4 auxiliary engines to power the fishing and processing equipment. The vessel makes 12 knots. (U. S. Embassy, Copenhagen, Sept. 20.)



United Kingdom

LOBSTER FARMING TO BE TRIED IN SCOTLAND

A team of skin-divers has begun work on a lobster-farming project at Kinlochbervie and new lobster storage tanks have been opened at Grimsby.

Instead of traditional creels, the Kinlochbervie divers are laying large cages 6' sq. and 8' deep to provide cover for young lobsters while they grow to commercial size. Pulford Estates Ltd., developers of the white fish industry in northwest Sutherland, will market the catch.

Storage at Grimsby

The Grimsby storage tanks were built for Minch Shell-fish Ltd. with a grant and loans from the Highlands and Islands Development Board. The new tanks should make a big difference to lobstermen in the Outer Isles, as the company hopes to take crabs, scallops, eels, and winkles, as well as lobsters. Initially, 3 people will be employed on the project, but additional labor will be hired when crab trade develops. ("Fish Trades Gazette.")



Iceland

MID-YEAR FISHERIES REVIEW

The greatly reduced herring and capelin catch this year, uncertainty about northern herring stock migrations and doubts about the fall herring catch all point to a 1968 catch well below last year's reduced level. The decline in fishery exports during first-half 1968 may foreshadow lower foreign-exchange earnings for all of 1968.

By August 24, herring catch was 38,418 metric tons; it was 156,661 tons in 1967. Capelin catch 78,073 tons; 97,165 tons in 1967. Gains in white fish catch have been more than offset by herring decline.

The small herring catch has meant decreased herring meal and oil production. Loss of the Nigerian market for dried white fish has meant that most white fish raw material has been salted and the rest used for freezing and reduction.

Herring Production

Salted herring production, amounting to 35,000 barrels by June, had not even begun in mid-1967. Advance 1968 contracts for salted herring total 347,000 barrels. The USSR has ordered 100,000 barrels, to be salted in Sept.-Dec. this year: 40,000 to be delivered before end of year, and 60,000 during Jan.-Mar, 1969. Prices are based on last year's dollar prices and have been increased in terms of kronur to cover last November's devaluation.

Exports Drop

Poor catches caused a 30.8% decline in fishery exports in first half this year and, considering last year's kronur devaluation, a 26% decrease in value from US\$45 million to \$33 million. Fishery exports declined over 30% in value last year.

On September 7 the government agreed to finance 75% of the Price Equalization Fund to offset fluctuation in export prices. When prices decrease, frozen product exporters are reimbursed for the amount of the decline. Initially, the fund was financed 50-50 by government and industry. Under the new settlement, government will contribute 75% and industry 25%. Price guarantees are based on the export prices of Dec. 31, 1967. The government also agreed to provide 25 million kronur (US\$1 57 kronur) in 1968 for payment to freezing plants in proportion to their outputs.

The quick-freezing industry's high domestic costs (costs and deficits in some cases were too great to benefit from last November's devaluation) and the importance of fishery exports made increased government assistance inevitable. (U. S. Embassy, Reykjavik, Sept. 12.)



LATIN AMERICA

Mexico

SURVEYS GULF OF CALIFORNIA

The Mexican Department of Fisheries has begun an intensive survey of Gulf of California fishery resources. It will be the most comprehensive survey of this area since the Japanese study made shortly before World War II.

As part of the Government's program to develop fisheries, the surveyors will measure both utilized resources and those with potential value.

Survey Areas

The first survey of the eastern shore will include the head of the Gulf and the western side as far as San Felipe. The survey will extend as far as Teacapan, Sinaloa, a few miles south of Mazatlan. Field work, begun in late August, will continue through September.

Survey Ships & Methods

A grid of trawl station lines has been laid out to cover the entire coastal area out to a depth of 20 fathoms. Eight shrimp trawlers donated by fishermen's cooperatives will make three 12-day trips each from Guaymas, Mazatlan, and intermediate ports. A biologist and a technician aboard each trawler will enumerate catches and evaluate results. Additional surveys out to 80 fathoms will be made by the large French trawler that recently conducted commercial fishing tests under a French-Mexican loan agreement.

Shrimp Studies

While the Gulf survey is underway, a related project is being carried on in the Gulf estuaries and lagoons. These areas are nursery grounds for young shrimp. Recent heavy increases in shrimp catches in Laguna Caimanero, near Mazatlan, have been attributed to construction of artificial drainage canals that provide clean fresh water. The current project is to study other bodies of water with similar physical improvement work in mind. (Regional Fisheries Attaché, U. S. Embassy, Mexico, Sept. 8.)

* * *

FISH CANNING IN BAJA CALIFORNIA

Baja California is the center of the Mexican fish-canning industry. The peninsula--State of Baja California and Territory of Baja California Sur--is an important producer of fresh and frozen lobsters, frozen abalone, totoaba, sea turtles, kelp, and other marine products. But canning and fish-meal manufacture are by far the most important parts of the industry.

Baja California State produces more marine products than any other state in Mexico; the port of Ensenada produces more than any other city. In 1966, the State produced as much as Mexico's entire Gulf and Caribbean coasts. Veracruz and Sinaloa, next highest-producing states, each produced less than half as much. Only Sonora and Sinaloa exceeded the State in value of production, while the Territory's catch value was sixth in Mexico. Shrimp, the principal fishery in Sonora and Sinaloa, have an extremely high unit value. In Baja, the largest fisheries are for species with a low unit price--sardines, mackerel, anchovies, kelp, and medium-price tuna. The fisheries for high-priced abalone and lobster are not large enough to bring Baja's total value up to first place.

Canning for Domestic Market

With two exceptions, all seafood canned in Baja California is produced for the domestic market. Canned tuna, sardines, anchovies, jack and Pacific mackerel, bonito, squid, mussels, and fish meal are sold entirely in Mexico. Baja produces nearly all the Mexican pack of abalone and tuna-scrap pet food.

Over half the abalone pack is exported to Asia and the U. S.; the U. S. imports all the pet food. Canned abalone is the second most valuable Mexican fishery export. In 1966, export value of canned and frozen abalone meat was US\$2,573,000. Baja produced 5,235 metric tons of fish meal in 1966, over half the total Mexican production.

History of Industry

Commercial fishing in Baja California began about 1928, when the first canneries opened at El Sauzal near Ensenada, and at Cabo San Lucas at the southern tip of the

Mexico (Contd.):

peninsula. Prior to World War II, three more canneries opened at Ensenada, and 2 or 3 small abalone plants were built farther south. Development was steady, and the fisheries now are the peninsula's largest industry. There are 13 plants in Baja; one packs only tuna, 2 produce only abalone, several can only sardines, mackerel, and anchovies; and a few can 2 or more of these. Six operate fish-meal plants using cannery offal and some whole fish.

The canneries compare favorably with plants in the U. S., Canada, and Japan. Some older ones have antiquated equipment and rely on hand labor, while others have replaced obsolete machinery. The newer ones, outfitted with the latest equipment, shine with stainless steel. Sanitation standards are very high, retorting times conform to the rigid requirements of the State of California. Some new canneries have imported practices, techniques, and even technicians from well-known plants in Spain. The industry blends the best from Mexico, California, and Spain.

Ensenada Canneries

The government-controlled Bank for Development of Cooperatives (BANFOCO) has incorporated 5 of the canneries in Baja California.

The largest fish cannery in Mexico, Pesquera del Pacifico (BANFOCO), was built 6 miles northwest of Ensenada to take advantage of a small natural harbor. Since then, the little bay has silted, and Ensenada has built a modern harbor. The fishing fleet unloads at the dock in the city, and the fish are trucked to the cannery.

Pacifico is more than a fish cannery. It is really a food processing complex producing a great variety of canned products, seafoods, fruit, vegetables, fruit juices, tomato paste and puree, pet food, and fish meal. Originally, the plant only packed fish, then began processing tomato sauce in which to pack the fish, and eventually branched into fruit and vegetables. A reduction plant has been added to utilize the fish offal.

Pesquera Peninsular (BANFOCO) is the oldest cannery in Ensenada. Formerly at the water's edge, it is now some distance from shore due to a land fill formed when the

modern harbor was built. The fishing boats unload at the dock, or into floating offshore hoppers connected to shore by submarine pipelines.

Peninsular specializes in packing sardines and anchovies in 4-oz. and 12-oz. rectangular cans. In late 1967, the plant began packing sea mussels gathered from rocks along the coast near Ensenada. Its fish-meal plant is equipped with a stick water plant for maximum utilization of cannery offal. Other Ensenada canneries give their fish offal to Peninsular; they find this more economical than operating individual plants to utilize small quantities.

The BANFOCO canneries are supplied by 2 company-owned purse seine fleets. The 3-vessel tuna fleet fishes as far south as Peruvian waters. The 6-vessel sardine and mackerel fleet fishes local waters. The larger refrigerated seiners go as far south as Isla de Cedros, taking bonito and yellow-tail as well as sardines and mackerel.

Three canneries are partly owned and operated by Spanish interests.

Empacadora Galicia de Baja California and Empacadora Mar pack sardines and anchovies as Spanish-style sardines.

Conservas del Pacifico, S. A. (COPASA) is owned 55% by a Mexican food, wine and olive producer, and 45% by a consortium of 3 Spanish canning firms. It packs the greatest variety of seafoods of any one plant in Mexico.

COPASA owns and operates the newest and only Mexican-built purse seiner in the tuna and sardine fishery. "Copasa," an all-purpose, refrigerated vessel, fishes both tuna and sardines. When sardines are scarce in local waters, she fishes in the Gulf of California and lands catches at Guaymas. There the sardines are cleaned and headed for shipment to Ensenada by refrigerated truck.

Empacadora Portena packs Spanish-style sardines, 1-lb. oval sardines, and mackerel in 1-lb. tall cans (salmon style).

The locally owned Empacadora Costa Azul cans abalone for export. For the domestic market, Costa Azul cans abalone, anchovies, and mackerel, and cooks and freezes lobster.

A fleet of privately owned small seiners provides anchovies, mackerel, sardines, and

Mexico (Contd.):

squid for the 7 Ensenada canneries. The fleet, about 25 boats 45-60 feet long, makes one-day trips, fishing in daylight. Their seines are ring nets, or modified purse seines without turntables. Catch sold for canning brings US\$40 a ton. The canneries are extremely quality conscious. Any anchovies not suitable for canning are used in the meal and oil plants and bring only \$16 a ton. High prices for tuna, sardines, and anchovies at Ensenada reflect high prices paid by nearby California canneries.

Southern Canneries

All canneries south of Ensenada are in extremely remote places. Their neighboring villages, from 1,000 to 1,500 people, depend almost entirely on the canneries, although there are lobster fisheries at 3 villages and one has considerable tourist business. Small company-owned refrigerated ships bring in perishables and carry out canned fish, fish meal, and frozen abalone meat. Coastal freighters also stop at some villages. All towns have airstrips for small aircraft required to haul out live lobsters. The towns are desolate, frontier-style, aggregations of shacks, but they are surrounded by a stark beauty of sea and desert that holds great attraction for visiting fishermen and yachtsmen.

One pioneer plant, Pesquera Isla de Cedros (BANFOCO), is on Cedros Island at the southern edge of Baja California State. It cans abalone and fish. Although at the southern edge of abundance of northern anchovy and mackerel, it is also at the northern limit of southern sardine, and draws seasonally from all these resources. Over 25 years ago, the cannery was described as "One of the cleanest I have ever seen." It still has a good reputation. A reduction plant uses cannery offal and whole fish.

Cedros is served by a company-owned fleet of 5 small purse seiners or ring net boats. As at other southern canneries, the abalone divers are members of the fishermen's cooperative associations that own the diving tenders.

Pesquera de Bahia Tortugas (BANFOCO), an abalone cannery in the northern part of Territory of Baja California Sur, is on the beautiful landlocked harbor of Bahia Tortolo

at Puerto San Bartolome. To early American whalers, it was known as Turtle Bay, and visiting yachtsmen and fishermen still call it that.

Empacadora de Baja California, at Bahia Asuncion, is the only abalone cannery without an unloading wharf. The supply ship and diving boats lie off the beach and transfer cargo by amphibious "ducks." Visiting fishery experts have described it as "one of the best operated small fish canneries we have ever seen."

Years ago a small sardine cannery was built at San Juanico, but it never got into production. All traces of the village have disappeared and only the abandoned cannery building stands as a reminder.

Bahia de la Magdalena, one of the world's largest landlocked harbors, supports two canneries. Though lying south of the northern anchovy abundance, they still can draw on what remains of the southern race of Pacific sardine. Thread herring and Pacific mackerel are canned as "sardines" and are used, with anchoveta and round herring, for fish meal.

Pesquera Matancita (BANFOCO) is near the northern entrance to Bahia Magdalena. Like other canneries in the south, it is a self-contained entity with power plant, water supply, air strip, company stores, etc. Unlike the others, it can receive some supplies overland via a barely passable road. Two complete fish-meal plants and two canning lines can handle 170 tons of raw material a day. Matancitas is supplied by 3 small purse seiners.

The other Bahia Magdalena plant, on Isla Margarita a little to the south, is probably the world's smallest combination sardine cannery and reduction plant. La Maritima, at Puerto Alcatraz, has a daily capacity of only 20 tons of raw material, which is supplied by 3 very small seiners.

Half Mexican Tuna Pack

Over half the Mexican tuna pack is canned at Compania de Productos Marinos at Cabo San Lucas. The cannery, at the extreme southern tip of Baja, has operated continuously since about 1929. This was achieved despite changes in ownership, damage from tropical storms, and a change in marketing

Mexico (Contd.):

from export to domestic in response to growing Mexican demand. Marinos has enough cold storage room for 200 to 250 tons of frozen tuna, but other equipment is somewhat outmoded; the plant depends on hand labor. Skipjack and yellowfin are packed as first-line tuna; bonito and yellowtail are labelled economy. Scrap is used for fish meal in the reduction plant.

Marinos' 4-vessel tuna fleet includes 2 veteran pole-and-line live bait boats that have fished out of Cabo San Lucas for years. A third boat, the largest tuna vessel in Mexico, can carry 310 tons of frozen tuna. The fourth is owned by an Ensenada fishermen's cooperative.

Several better-known tuna fishing banks are closer to Cabo San Lucas than to Ensenada, and Marinos has a larger canning capacity than Pesquera del Pacific, Ensenada. So they have worked out an informal arrangement allowing Ensenada vessels to sell catch at San Lucas when Pacifico cannot handle the fish--or when an Ensenada vessel must put into port with a catch too small to make a trip home worthwhile.

Conservas de California is a vegetable cannery in La Paz on the Gulf of California. It specializes in canned chilis and olives, but occasionally it packs small quantities of specialty sea foods.

Can Factories

Can factories in Ensenada and Monterrey provide standard-size cans for all Baja California canneries. Odd sizes and shapes, not available from Mexican can makers, are imported from the U. S. Canned fish may be shipped into Mexico from the Free Zone of Baja California duty-free, even when imported cans are used.

Practically all canneries use their own labels and brand names and also pack under other labels for distributors. The 2 principal tuna canners share some brand names and pack for one another when orders get ahead of production.

The huge growth of the fish-canning industry has come from the tremendous expansion of consumer demand during Mexico's economic development. Imported canned fish

has always been in great demand among higher income groups, and a bewildering variety of products is still imported from Europe, North America and Asia. As potential consumers increased, domestic canners took advantage of the growing market and began packing competitive products that are acknowledged copies of well-known imported favorites. There is a proliferation of Spanish- and Portuguese-style sardines, squid, mussels, U.S.-style tuna, and salmon-style mackerel (there are no salmon in Mexico). Many labels even show the names of foreign companies that provided techniques and technical supervision.



Peru

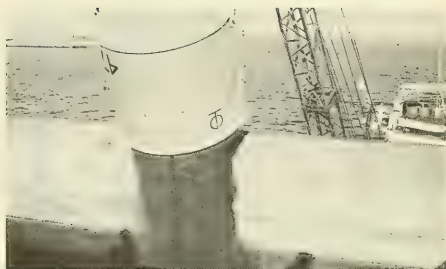
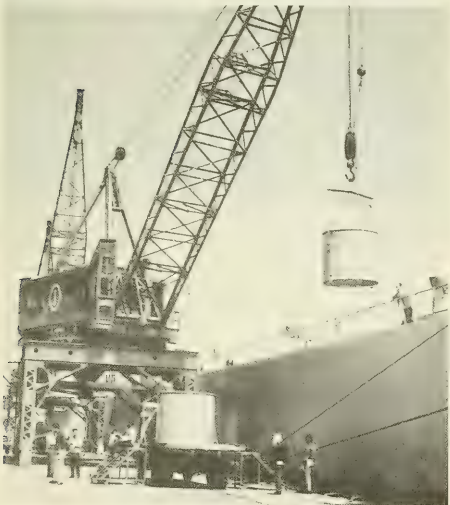
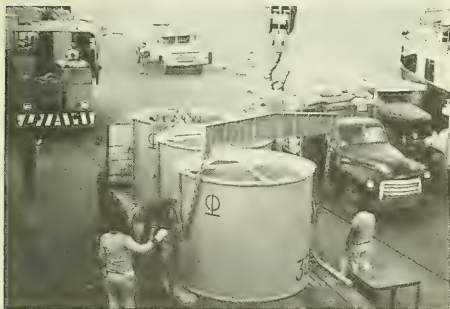
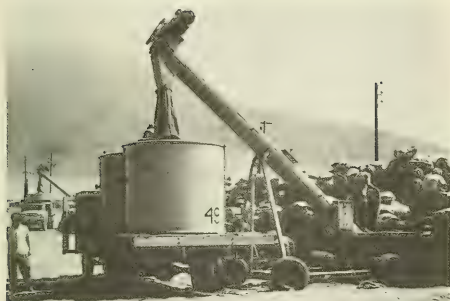
FIRST PERUVIAN BULK SHIPMENTS OF FISH MEAL

The first bulk shipments of fish meal from Peru apparently were a complete success. In 8 working days (between June 24-July 4), 15,197 metric tons of bulk fish meal were loaded aboard a tanker, an operation normally requiring 13 days with the same quantity of sacked meal. The operation was repeated in August.

The bulk meal requires only 57 cubic feet per ton, compared with 80 cubic feet per ton for sacked meal. Proponents of the new system claim up to \$10 per ton may be saved by shipping in bulk.

The experimental loading was carried out in Chimbote. Meal was dumped from sacks by hand and transferred via small conveyers into large canisters carried aboard trucks. (The canisters were 6 feet high by 5 feet 11 inches in diameter, and hold 2½ tons of meal; each required 4 minutes to fill. Each truck carried 2 or 3.) The canisters were trucked to dockside, lifted individually by crane, and the meal emptied into the hold of the tanker. The first operation employed 70 canisters, 3 cranes (with another held in reserve), 35 trucks, and about one-third the personnel required in the normal sacked-meal loading operation. The record operation employed 40 trucks and 90 canisters. All the meal was treated with a liquid antioxidant (Etroxiquina) and was subject to the requirements of the vessel owner and underwriters: cured for 21 days, treated with a minimum of 100 grams of

Peru (Contd.):



Photos: "Pesca."

antioxygant per ton, fat content of the meal at time of shipment no more than 12 percent, and with temperature, moisture content, etc., similar to normal meal. During shipment, the holds were sealed and filled with inert gas, and the oxygen level kept below 2 percent.

The experimental shipments were undertaken by 7 firms, all members of the Peruvian Fisheries Consortium. The meal was loaded aboard the Dutch vessel "Thuredrecht" bound for Rotterdam. The vessel made the trip in 20 days, unloaded its cargo in 1 day, and returned immediately to Peru. Another shipment was made August 20. Engineers plan to reduce loading time to 6 days by using larger cannisters (7 feet high, 6 feet in diameter, and holding $3\frac{1}{2}$ tons of meal) and reducing to 55 cubic feet the area required for a ton of meal. Another shipment was scheduled for October 17. ("Pesca," July 1968.)

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JAPANESE FIRM TO INVEST IN FISH PRODUCTION

Taiyo Fishery Co., one of Japan's leading fishery firms, is planning to buy all the shares of Industriad Del Mar (INMAR); the Japanese company already owns 50%. Taiyo believes that a wholly owned subsidiary will be profitable because fish meal export prices have stabilized and the anchovy catch has increased. The company also intends to buy 2 fish meal plants to expand its business in Peru.

Fish Meal Plants

The INMAR fish meal plant at Atico, close to the Chilean border, is too far from the

Peru (Contd.):

fishing grounds to operate efficiently. Taiyo wants to acquire plants at Chimbote, in northern Peru, and at Callao and Pisco, in central Peru, to even out operations. Two companies will be selected from about 10 local firms.

To Increase Production

Taiyo, hoping to have INMAR operate about 30 fishing boats, expects to increase fish meal production to 100,000 metric tons annually--about 3 times present capacity. The Japanese company also plans to include shrimp, tuna, and sea bream in INMAR's operations. ("Japan Economic Journal," Oct. 8.)



Nicaragua

PRODUCTION AND EXPORTS

During the first 6 months of 1968, the Nicaraguan fishing industry produced nearly 3.5 million pounds of fishery products--mostly shrimp and lobster--worth over \$3 million. Nearly all the shrimp was exported, primarily to the U. S. Between 71 and 81 shrimp vessels and 45 to 53 lobster boats operated during the period.

Jan.-June Production and Export Totals		
	Production	Exports
	. . . . (1,000 Lbs.) . . .	
Shrimp, frozen. . .	2,758.8	2,831.3
" dried . . .	521.6	65.3
Lobster, spiny. . .	147.2	155.5

(Instituto de Fomento Nacional, "Boletin Informacion Pesquero No. 8.")



Chile

JAPAN EXPLORES FOR TUNA OFF CHILE

The Japanese Fisheries Agency has released the first interim report on the tuna long-line explorations by the research vessel "No. 31 Azuma Maru" (340 tons) in the upper latitudes off the coast of Chile.



At Puerto Montt, southern Chile, customers buy directly from fishing boats at low tide. (FAO/S. Larrain)

Areas Explored

The vessel made 24 sets in the first of 4 survey areas, 20° S.-35° S. and 100° N.-130° N., from May 23-June 25. The 31 metric ton catch--albacore 14 tons, bigeyed 8 tons and others--did not include black tuna. The vessel operated in the second area, 20° S.-35° S. and 70° W.-100° W., from July 4-Sept. 21. ("Suisancho Nippo," July 9.)



ASIA

Japan

STUDIES MERGER OF TUNA PACKERS

The Tuna Packers Association has published an interim report proposing packing plant mergers and industry modernization. The 139 plants owned by 112 firms would be reduced to 43 initially and to 14 through later mergers.

Industry Difficulties

Independent tuna packers are having trouble with raw material and labor problems, increasing competition in foreign markets, and weakening competitiveness of the Japanese product. As South Korea and Taiwan are likely to begin tuna packing, Japan must strengthen her international competitiveness. The industry must accelerate modernization by streamlining production processes and consolidating operations.

Initial Merger Plans

Mergers would increase production by combining and mechanizing operations. In the U. S., 20 packing firms produce 20 million cases of canned tuna a year. The top seven pack 19.3 million cases, or about 2.8 million per firm. In Japan, 112 packers produce 6 million cases a year at 139 plants, or about 43,200 per plant. Assuming that 500 cases per day is the minimum output for economic plant operation, to pack 6 million cases the 112 packers could operate only 107 days a year. However, if machine-packing is adopted, minimum daily production would have to increase to 700 cases, plants would have to operate 200 days a year and minimum annual production per plant would thus be 140,000 cases. To pack only 6 million cases a year, the number of plants would have to be reduced to 43. Increasing efficiency by using more packing machines and other modern equipment will necessitate further mergers.

Later Mergers

A second merger would reduce the number of plants to 31, producing 1,000 cases a day per plant and increasing overall annual production to 6.2 million cases. The

fifth merger would cut plants to 14, each packing a minimum of 500,000 cases a year, for a total annual production of 6.8 million cases.

Proposed Programs

Cooperatives would be established for each group of packers. Means must be found, under existing law, to extend loans to the cooperatives and to assist packers who want to retire or transfer to other industries. Two different programs have been proposed to implement the mergers. One would set up a US\$0.5-1 million subsidy program to assist packers withdrawing from the industry. It would be financed either half by the Government or wholly by the industry, 50-50 between packers and can manufacturers. The other program would set up a Government-financed purchasing agency to buy lots, plants, and business licenses from retiring owners. Land and facilities would be sold to parties other than tuna packers and the business licenses sold only to packers. No new license would be issued, restrictions would be imposed on "outsiders" (packers not belonging to the Association), and fixed performance quotas established. ("Suisan Tsushin," Sept. 13.)

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DISBANDS TUNA PROMOTION ORGANIZATION

The Japanese International Tuna Association, formed in 1956 to promote frozen and canned tuna exports to the U. S., is to be dissolved. The Association has been promoting tuna exports with funds provided by a 50% government subsidy, matched by contributions of 25% each from the frozen tuna producers and the canned tuna packers. However, frozen tuna producers, faced with growing production and export problems, have questioned the need for such a program, and their resistance has led to the decision to end the program. Future export promotions will be undertaken by the Japan External Trade Organization (JETRO), with government subsidy. ("Nihon Suisan Shimbun,")

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Japan (Contd.):

TUNA PRICE
STABILIZATION CONSIDERED

The Federation of Japan Tuna Fisheries Cooperative Associations (NIKKATSUREN) is studying measures to stabilize tuna prices, primarily yellowfin, which have dropped more than usual. NIKKATSUREN wants to build its own cold storages to regulate domestic tuna supply and so stabilize prices. In the export market, Japan alone cannot stabilize prices; she must seek the cooperation of South Korea and Taiwan.

Demand High Quality

Study of the domestic market indicates that demand for high-quality fresh tuna will grow. Consumption of medium- to high-grade fish is increasing in rural communities; since medium-quality tuna is abundant, market demand for it must be stimulated. Promotion of fresh-fish consumption is important because tuna bring higher prices on fresh market (for "sashimi" and "sushi" trade) than when sold to packers. However, consideration also must be given to stabilization of supply to the packers, who annually use over 100,000 metric tons of raw tuna. They are faced with shortage of raw material.

Adjust Tuna Supply

To adjust tuna supply on domestic market, NIKKATSUREN would have 5,000- to 10,000-ton capacity cold storages at Yaizu, Shimizu, and Misaki. Yellowfin landings would be stored during May, June, and July, when prices decline; they would be released after September, when prices begin going up. Normally, yellowfin prices decline during those months from around US\$529 a short ton to \$403-454 a ton exvessel, but this year prices fell to \$333-365 a ton.

As for storage methods under the supply adjustment plan, NIKKATSUREN either could buy the tuna landings, or store them for sale on a consignment basis. Since cold storages would have to be operated year-round, they also could be used seasonally to store albacore, skipjack, and bait saury.

Export Market

S. Korea and Taiwan have begun turning to the Japanese market because of price de-

clines in other markets. Taiwanese fishermen are taking many bluefin tuna in the Indian Ocean. They want to sell them to Japan because there is no market in Europe or the United States and Taiwanese demand is very limited.

Some Japanese feel tuna imports should be handled through one agency and conform with NIKKATSUREN's price-stabilization program. However, many fear that imports of foreign-caught tuna would amount to supporting foreign fleet expansion. They want the countries seeking markets in Japan--South Korea and Taiwan--to agree to stop enlarging their fleets. Under present circumstances, this is questionable. ("Suisan Keizai Shimbun," Sept. 18 & 19.)

* * *

TUNA PACKERS HAMPERED
BY SHORTAGES

Packers in Yaizu and Shimizu pack close to 80% of all of Japan's canned tuna. They are being hampered by a raw fish shortage, caused by poor landings of summer albacore and a slow fall season skipjack fishery. Normally, when fruit packing ends in early September, packers switch to full-time tuna canning. Short supplies of albacore and skipjack are making it hard for them to keep going until tangerine packing start in November.

Possible Plant Closures

Some packers feel they should suspend production rather than lose money keeping plants open. However, if they stop, they have to pay their workers over 60% holiday pay to keep them for the next fruit-packing season. Besides, production stoppage would delay fund turnover and adversely affect the plant's financial position. ("Suisan Keizai Shimbun," Sept. 6.)

* * *

ATLANTIC ALBACORE
SHIPPED HOME

The extremely poor summer albacore fishery off Japan and a domestic raw material shortage have caused some Japanese firms to ship albacore taken off Angola back to Japan. Some firms preferred to ship catches home rather than sell to other countries, because the small (about 13 kilograms or 28.6 pounds)

Japan (Contd.):

and fair quality fish either were rejected or brought very poor prices on the export market. Japanese packers, paying \$428-454 a short ton, claimed the Angola-caught albacore yield was low, only about 50% recoverable for brine-packed tuna production.

The fishery off Angola was still good in August despite the passing of the peak fishing season. Vessels were catching around 3 tons per operation. ("Katsuo-maguro Tsushin," Aug. 1.)

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AVERAGE PRICES OF FROZEN TUNA EXPORTS TO U. S., JUNE-SEPT, 1968 & 1967

Species	Prod.	Export Prices Average				Quantity Exported
		June	July	Aug.	Sept.	
		(US\$/Short Ton, f.o.b. Japan) . . .				Short Ton
Albacore	Rnd.	450 (424)	453 (462)	456 (472)	451 (472)	92 (835)
Yellowfin	gill. & gutt.	364 (352)	366 (400)	368 (397)	371 (409)	3,836 (2,042)
Albacore	loin	1/920 (892)	933 (913)	991 (948)	1,008 (990)	75 (150)
Yellowfin	loin	805 (797)	807 (863)	811 (897)	848 (890)	106 (28)

Note: Prices in brackets are for same months in 1967.
1/Only one shipment in month.
Source: Fisheries Attaché, U. S. Embassy, Tokyo, Oct., from Japan Frozen Tuna Exporters' Assoc.

* * *

BERING SEA GROUND FISH CATCH UP

Twelve mothership-type bottom trawl fleets in the Bering Sea had taken 505,000 metric tons of fish by July 25, about 20,000 tons more than in 1967. The high catch was due entirely to the large amount of Alaska pollock taken by 5 meal and minced meat factoryship fleets. Catches of most other species were sharply below last year's. Pacific ocean perch landings of 3,000 tons were 13% of 1967's catch and the 7,000-ton herring landings were less than one-third. Herring catch was low because there were no good concentrations of egg-bearing fish off Cape Olyutorski. In early August the four herring fleets in that area began fishing tanner crab. ("Nihon Suisan Shimbun," Aug. 7.)

* * *

1967 FISHERY CATCH HIT HIGH

Data from the Japanese Agriculture and Forestry Ministry indicate that 1967 fishery production was a record 7,824,000 metric tons (excluding whales). This was 10 percent, or 722,000 tons, more than 1966 landings of 7,103,000 metric tons. (On April 12, 1968, the Ministry had released preliminary data showing 1967 fishery production about 7.7 million metric tons.)

Marine fisheries accounted for 7.24 million tons of the total, 10 percent more than 1966's 6.56 million tons. ("Suisan Tsushin.")

* * *

IMPLEMENTS KENNEDY ROUND TARIFF CUTS

On July 1, Japan effected a simultaneous tariff reduction on imports. Under the Kennedy Round, Japan agreed to a two-fifths cut on items listed for a 50% reduction over a 5-year period. Frozen tuna and salmon, and canned fish are among fishery products affected by the reduction. Initial cuts on fishery products will reduce the 10% duty on frozen fish imports to 8% and the 20% duty on canned fish to 15%. Fisheries Agency officials and industry leaders foresee no serious adverse effect on the domestic industry. Some observers feel that the reduced levy may serve to stimulate rising frozen tuna imports. ("Nihon Suisan Shimbun.")

* * *

SHRIMP IMPORTERS ADOPT STANDARD PURCHASE CONTRACT

The Marine Products Importers Association adopted a standard contract for use in purchasing shrimp from foreign countries (excluding Mexico). The contract will protect Japanese trading firms against heavy losses when shipments contain uneven-sized shrimp or weight shortages. Such cases have occurred frequently in deliveries from southeast Asian countries this year. Claims of contract violations are difficult to settle under present procedures, since the buyer, by means of letter of credit, makes full payment at the time of purchase. The new contract, while not stipulating any definite amount payable by letter of credit (the Association plans to negotiate for an 80-percent L/C payment), does

Japan (Contd.):

provide for final inspection of shipment at the port of destination instead of accepting delivery on "f.o.b. final" conditions.

Mexican Imports

Imports from Mexico will be regulated voluntarily to avoid oversupply. Trading firms importing shrimp from Mexico will notify the Association of the quantity loaded on vessels. When the quantity reaches a certain level, the Association will advise importers not to order any more shipments during that month. Claims against Mexican shrimp will be handled jointly by the trading firms. ("Suisan Tsushin," Sept. 20.)

* * *

EXPECTS TO IMPORT 4,000 TONS
SALMON ROE

Salmon roe imports from Alaska and Canada began in July, but by August 15 total imports were only 130 metric tons.

Production

The pink salmon season peaked in mid-August in all parts of Alaska (Bristol Bay, Cook Inlet, Prince William Sound, and Ketchikan), but the ratio of males was higher than expected and salmon roe production was low. Nevertheless, combined Alaskan and Canadian salmon roe production was expected to reach 4,000 tons.

Prices

Red salmon roe prices started about 7 cents a pound below the first price last year. No appreciable price fluctuation has been noted since. Demand was high at mid-August and there was a shortage of salmon roe produced by factoryship. Prices were expected to remain stable until the season's peak in September and October. There will be a carryover to next year if production does reach 4,000 tons.

Mid-August shore prices per pound were: chum salmon roe: first grade US\$2.60; second grade \$2.50; third grade \$2.40. Red salmon roe: first grade \$2.40; second grade \$2.30; third grade \$2.00. Silver salmon roe: second grade \$2.00; third grade \$1.80. ("Suisan Tsushin," Aug. 17.)

* * *

IMPORTS MINCED FISH FROM TAIWAN

Edible fish cake processors in southwestern Japan, faced with an acute shortage of raw material, are planning to import "surimi" (minced fish meat) from Taiwan. Recently survey teams sent to Taiwan found an abundance of lizardfish and croaker, suitable for "surimi." The processors will provide technical assistance for production of fresh, high-quality material. ("Suisan Keizai Shimibun,")

* * *

IMPORTS SOVIET FISH MEAL

Five major trading firms have imported about 4,000 metric tons of white fish meal from the USSR. This was Japan's first purchase of Soviet fish meal this year. In 1967, a shipment of Soviet meal could not clear Japanese Customs and was exported to another country.

Prices

Import price was about US\$172-175 a metric ton, Yokohama warehouse delivery, about \$11.00-14.00 lower than the Japanese factoryship meal price. ("Minato Shimibun," Aug. 22.)

* * *

SWORDFISH EXPORT PRICES
AT RECORD HIGH

Export prices for swordfish shipments to the U. S. reached a record high in July. Prices for swordfish fillets (50-70 pound size) in July-Aug. were around 55 cents per pound c. & f., about 20 U. S. cents above comparable 1967 prices which averaged 34.2-35.2 U. S. cents. This sharp gain is attributed to poor swordfish landings in the U. S. Low production in Canada and Peru, the two other major swordfish suppliers, also contributed to the price rise. Prices per pound for swordfish exports to the U. S. during first half 1968, for 50-70 pound size fillets c. & f., rose from 39.7 cents in January to 47.6 cents in June. ("Suisan Keizai Shimibun," Aug. 13.)

* * *

WHALE OIL PRICES DOWN

Estimated fin whale oil production for the current North Pacific whaling season is about 15,500 metric tons. Contract price of about

Japan (Contd.):

US\$130 a metric ton is about \$10 below the price for fin whale oil produced in the Antarctic whaling season. Whaling companies have made concessions because the total production will be sold on the domestic market. Producers are satisfied despite the low contract price because the overseas market for soybean oil, fish oil, and fin whale oil is extremely slack.

Down \$30 A Ton

Sperm whale oil production for the current North Pacific whaling season is estimated at 20,000 tons. Prices are expected to be about \$142 a ton, compared to last season's \$172. Nearly all the sperm whale oil production will be sold to domestic users.

* * *

OYSTER CANNERS CUT PACK

The canned oyster pack this year will be reduced 35% from last year, to 1.25-1.30 million cases. Despite such a marked reduction, many cannery have large inventories totaling 200,000-250,000 unsold cases.

Large Inventory

The large stocks have accumulated due to an inactive export market, and uncertainty in purchases because of canned oyster production in the Gulf area of the U. S. Financial help is needed to prevent cannery from selling at low prices, causing chaos in the market. Hiroshima cannery had planned to extend some financial help to cover unsold stocks, but the help had not materialized by mid-July.

The market is expected to improve this fall and winter. ("Suisan Tsushin, July 12.)

* * *

FREEZES SEA URCHIN EGGS SUCCESSFULLY

A simple method of freezing sea urchin eggs has been perfected by the Iwate Prefectural Fisheries Laboratory. Sea urchin eggs, a delicacy in Japan, are served raw at high-class "sushi" restaurants. "Sushi" is raw sliced fish served on rice. Chemical

preservatives, ordinarily used to retain freshness, produce an off-flavor after extended storage. In new freezing technique, fresh eggs are soaked in brine for about 10-15 minutes and then are quick-frozen. This may open a new field in sea urchin egg processing. ("Minato Shimbun," Sept. 17.)

* * *

AGAIN SEEKS PROTECTION FROM GEAR THEFTS OFF MEXICO

The Federation of Japan Tuna Fisheries Cooperative Associations (NIKKATSUREN) has again asked the Japanese Fisheries Agency to send a "guidance" vessel to the waters off Mexico to protect Japanese vessels against continued gear thefts. During April to July, 13 cases of gear thefts, amounting to over US\$10,000 in losses, were reported by Japanese long-liners fishing off Mexico. NIKKATSUREN fears that continued occurrence of such interferences could lead to conflict on the high seas. This problem, however, is presenting considerable difficulties to the Agency since it cannot file protests without knowing the nationality of the offending vessels, and sending of a "guidance" vessel to such distant waters would entail much expense. ("Katsuo-maguro Tsushin," Aug. 6.)

* * *

CANNED MACKEREL MARKET IN U. S. SURVEYED

The Japan External Trade Organization (JETRO) has reported the results of the canned mackerel and saury marketing survey conducted in the U. S. The survey revealed that in Atlanta, Georgia, Negro housewives were the principal consumers of canned "wet fish," and market demand will continue at present level.

Hopeful About U. S. Market

The Japanese hope the U. S. market, which only recently began importing canned mackerel in quantity, will provide a good outlet for the Japanese product. Between December 1966 and early 1967, the U. S. imported from Japan 200,000 cases of canned jack mackerel and 445,000 cases of canned Pacific mackerel.

Japan (Contd.):

Atlanta Survey

In Atlanta, canned jack mackerel were the most widely used canned "wet fish." Interviews with Negro householders showed that 91-93 percent of the respondents in all income categories used canned jack mackerel, while only 4-13 percent reported buying canned Pacific mackerel. The market for canned saury was very limited. Between 90-94 percent of the Negro housewives of all age groups reported using canned jack mackerel. Among the white population, only 16 out of 100 respondents said they used canned mackerel. Among the canned "wet fish," jack mackerel was the most popular because of its lower price (according to 97 percent of the respondents).

Served in Several Ways

Housewives said they served canned fish in fish loaf, salad, and sandwich, in that order. Canned tuna was by far the leading choice, followed by canned salmon. Retail stores surveyed showed that most of the retailers in Philadelphia and Atlanta handled canned jack mackerel, while only a few chain stores carried canned Pacific mackerel. The canned saury market was extremely limited. As for the country of origin of canned mackerel marketed in Philadelphia and Atlanta, 7 out of 13 chain stores said they sold only U. S. domestic products, while 4 reported handling imports from Japan and 2 said they carried South African products. ("Nihon Suisan Shimbu.")



Malaysia

SARAWAK'S FISH IMPORTS
DRAIN FOREIGN CURRENCY

In 1967 Sarawak imported about US\$670,000 worth of salted, dried, and boiled fish; about \$180,000 worth of fresh-frozen or refrigerated fish; and almost \$670,000 worth of canned fish. Fish must be imported to meet Sarawak's needs from October through January when local fishing comes to a halt. This off-season, known as "Landas," causes the State an annual loss of over \$1.5 million in foreign currency.

Lack of Local Facilities

Sarawak lacks fish-freezing and refrigerated-storage facilities and has no efficient marketing organization to help solve the currency drain problem. Furthermore, there are no large fishing vessels above 100 tons capable of fishing during "Landas."

Inshore Trawling Opposed

Fearing depletion of stocks, local fishermen are opposed to trawling inside the 30-fathom limit. The Marine Fisheries Department is considering new regulations limiting trawl depth and net mesh size. The Department wants trawling to continue so that the fishing industry can become self-supporting. Eight trawling licenses were issued in 1967 but foreign companies' requests to trawl in Sarawak waters were rejected because of local opposition. (U. S. Consulate, Kuching.)

* * *

UNDP FISHERIES TRAINING CENTER

The Malaysian Government has asked the United Nations Development Program (UNDP) for assistance in establishing a fisheries training center at Penang. The UNDP will contribute US\$1,336,700; the Malaysian Government \$1,441,000. The Food and Agriculture Organization (FAO) will administer the 5-year project.

Training Program

The present fishing industry, confined almost entirely to shallow inshore waters, operates with small, rather primitive vessels and old-fashioned gear. Introduction of more sophisticated equipment and vessels, for expansion into offshore waters, will require training of crews and technicians. Crews and technicians will receive training in navigation, fishing, and operating vessel engines. Three different courses will be given--short courses for existing crews in operation of sophisticated vessels and gear; longer courses for new crews; and courses on modern shrimp fishing for trainees from Sabah and Sarawak. An international training team will include a project manager, a chief instructor, 2 master fishermen, a fishing gear expert, an electronics specialist, and consultants. UNDP will provide expert services, fellowships, a training vessel, fishing gear, vehicles, and equipment for shore training.

Malaysia (Contd.):

Upon termination of UNDP support, the Malaysian Government will operate the center.

Changes in Fishery Industry

Introduction of improved fishing gear and mechanization of fishing vessels is changing Malaysia's fishing industry rapidly. Vessels with inboard engines increased from 1,500 in 1957 to 9,300 in 1966. During the same period, annual fish catches in West Malaysia increased from 111,000 metric tons to 234,000. The profitable centralized trawl fishing is expanding. In East Malaysia, foreign companies and local enterprises are participating in the expanding shrimp fishery.

Conflict With SE Asia Center

The UNDP project may conflict with the Southeast Asian Fisheries Development Center, approved by the Manila Conference on Southeast Asian Agricultural Development in April 1967. That Center, composed of an oceanic fishery training division in Bangkok and an oceanic fishery research division in Singapore, was to train fisheries technicians of the Southeast Asian countries, to develop fishing grounds and to investigate fishery resources of Southeast Asia. The original agreement, drafted by Japan, called for a flat assessment of member countries. This was rejected with Malaysia's initiative. A revised agreement recommended voluntary contributions of unspecified amounts. Establishment of the UNDP supported Fisheries Training Center may induce Malaysia to withhold financial support from the Manila project. If other members follow such a policy, the Southeast Asia Center would collapse.



South Vietnam

CONSTRUCTS FISHERY PROJECTS WITH U. S. AID

The Agency for International Development (AID) will contribute over US\$42,000 to a joint project to rebuild La-Gi harbor in Binh Tuy province. Availability of a usable harbor should increase the local fish catch considerably.

Builds Saigon Wholesale Fish Market

Construction of the U. S. financed Saigon wholesale fish market began in June. The project, consisting of a wharf, a wholesale fish market, and a cold-storage plant should be completed by the end of the year. (AID Saigon.)



North Vietnam

USSR AIDS FISHERIES

The research vessel "Onda" of the Pacific Institute for Fisheries and Oceanography (TINRO) returned to Vladivostok in June after an 18-month cruise to North Vietnam where Soviet specialists trained fishermen, helped organize shore processing plants, and advised on marine fisheries development.

Soviets have intermittently provided fisheries aid to North Vietnam since the early 1960s. They have joined the North Vietnamese in fisheries research in the Gulf of Tonkin. Most of this joint research effort has been conducted by TINRO scientists.

Cooperative fisheries research was initially sponsored by the West Pacific Fisheries Commission which included, in addition to North Vietnam, North Korea, Communist China, and Mongolia. After the Chinese withdrew from the Commission in 1966, the USSR continued aid to North Vietnam and North Korea on a bilateral basis.

Gulf of Tonkin Survey

A comprehensive survey of fishery resources in the Gulf of Tonkin was carried out in 1959-1960 by 3 TINRO vessels: "Onda," "Pelamida," and "Orlik." Similar research continued in subsequent years.

In late 1965, under a Technical Assistance Program, the USSR supplied Hanoi with 3 medium freezer trawlers ("Maiak" class of about 800 gross tons). These vessels can stay at sea for 50 days and have a 200-metric-ton fish hold capacity.



Pakistan

FISHING INDUSTRY PROGRESSES

The income of West Pakistan fishermen has increased appreciably in the past decade with government, U. N., and U. S. assistance. The 9-year-old fish harbor and market at Karachi has affected the lives of fishermen and their families. The fishermen are mechanizing their boats, getting better gear and equipment--and making larger catches. Still, only a minority of the more than 5,000 fishing boats along the W. Pakistan coast has been mechanized.

Fishermen's Cooperative Builds

A fishermen's cooperative has built and equipped a hospital, schools in some villages, and provided fresh, pure water. Helping in these developments were the U. S. with money and equipment, and FAO with plans for the harbor and market.

Facilities at the fish market include stores for nets, gear, equipment spares, oil and petrol. These supplies are available cheaply at easy terms by the fishermen's cooperative society.



Fig. 1 - Fishermen strain Karachi surf for small fish and crabs. Karachi harbor is to the right; to the left is a small island, near which masts of a sunken ship indicate shoals. (FAO/W. Williams)



Fig. 2 - Typical net-repairing scene on the jetty. (FAO/J. Olsen)



Fig. 3 - Dried fish for auction. Both fresh and dried fish of all kinds and crustaceans are auctioned. (FAO/J. Olsen)

Pakistan (Contd.):



Fig. 4 - Fresh fish from the Arabian Sea are brought to this busy Karachi market every day. (FAO/W. Williams)



Fig. 6 - Boy selling "Kachra" at fishing village 11 miles from Karachi. (FAO/W. Williams)



Fig. 5 - Fish-drying yard in Karachi.

SOUTH PACIFIC

Australia

TASMANIA HAS GOOD FISHERY POTENTIAL

Interest abroad is growing in the fishery potential of areas adjacent to Australia's Tasmanian territorial waters. There have been reports of substantial concentrations of fishery resources that indicate a good future for joint ventures by foreign and Australian businessmen.

From small beginnings a few years ago, abalone fishing has developed into an important export industry. It is second in importance among all Tasmania fishery products only to the spiny lobster. Industry growth was (weight in lbs. of meat):

	1966	1965	1964
Quantity	970,000	403,400	103,200
Value	A\$350,000	A\$101,000	A\$25,700

More substantial growth is expected in the near future.

Companies Active

Safcol (Tas.) Pty. Ltd. and Planet Fisheries (Tas.) Pty. Ltd. are processing abalone in Tasmania. A factory at Margate, operated by Gourmet Sea Foods, is producing tenderized abalone steaks mainly for export to the U. S. and the Orient. W. Angliss and Co. (Aust.) Pty. Ltd. plans to expand all over Tasmania in fish processing. This project is expected to take up to 10 years and cost over \$3,000,000. (U. S. Consul, Melbourne.)

Note: A\$1 = US\$1.12.

* * *

SOVIET SHRIMP FISHING IN GULF OF CARPENTARIA CREATES UPROAR

The Soviet stern trawler "Van Gogh" fishing shrimp in the Gulf of Carpentaria has caused an uproar in Australia. Australian fishermen claim that Van Gogh wailed her sirens at them as soon as sizable shrimp stocks were spotted, forcing them to scatter to prevent collision with the giant Soviet vessel. This harassment is blamed for having deprived the Australians of \$24,000 worth of

shrimp in one sweep. Some fishermen "took a couple of shots at the vessel with a carbine." Prime Minister Gorton ordered a Royal Australian Air Force plane to patrol the Gulf and dispatched an armed Navy patrol boat. The Government has protested to the Soviet ambassador in Canberra against alleged intimidation and harassment of Australian trawlers by the Van Gogh. Despite this, the Van Gogh rescued the crew of an Australian trawler sinking in the Gulf, and the Soviet captain threw a vodka party for them. ("The Washington Post," July 12 & 14; Radio Melbourne, July 11; UPI, July 13.)

Van Gogh

The Australian press reports the Van Gogh is trawling for shrimp in 8 fathoms 40 miles off Karumba on the southeast coast of the Gulf. She can catch and process 70 tons of shrimp in 24 hours. She has a fish meal plant to process offal and less valuable species and is believed to be the mothership of 10 smaller freezer trawlers. The vessel carries a crew of 103, including a number of scientists, 33 women, 2 physicians, a dentist, and a nurse. The Van Gogh is apparently surveying shrimp resources and may be exploring for other species since she carries nets with mesh sizes too large to catch shrimp. (U. S. Consulate, Brisbane, July 2; "Brisbane Courier Mail," July 2 and 3; "The Telegraph," Brisbane, July 1.)

Industry Expansion

Australia has been preparing a major expansion of the shrimp industry into the Gulf of Carpentaria since 1963, when researchers found commercial stocks there. Schooling by sexually mature shrimp occurs in the Gulf from March to September; the schools provide the commercial catch. Exploratory trawling, which landed over 70,000 pounds of mixed shrimp during the last 12 months, has prompted commercial Australian companies to plan construction of 6 to 10 shrimp-fishing ports from Darwin to Cape York, and to look for 200-300 shrimp boats in the Gulf by mid-1969. ("Fishing News International," June 1968.)



AFRICA

Ghana

PLANS FISHING INDUSTRY EXPANSION

Since the fishing industry has been able to meet only 50% of the annual fish requirements, the government is planning on expansion of fisheries aid. A Fisheries Training School is being established with Norwegian assistance, US\$1 million working capital will be provided for the State Fishing Corporation (SFC), and the harbor at Takoradi will be expanded to relieve overcrowding at Tema. In January 1969, fishing gear will be placed on an open general import license making it more readily available to local fishermen.



Fig. 1 - Japanese tuna boat unloading in harbor of Tema, Ghana.



Fig. 2 - Small trawlers landing fish in Tema.



Fig. 3 - A fisherman seining.



Fig. 4 - Ghana's coastline has no natural harbors and surfboats are commonly used. (FAO Photos: A. Defever)

State Fishing Corporation

SFC, which has been losing money since its inception in 1961, has yet to fulfill its quota of fish for the local market. After the government announced that it was giving the corporation a "second chance," SFC began an internal reorganization. Several senior officers were dismissed and over 100 others were asked to re-apply for their jobs--only the most qualified will be rehired.

Ghana (Contd.):

Trawler Conversion

A Japanese firm has offered to convert the Government's 10 Soviet-built trawlers into tuna fishing vessels. The trawlers, idle since the February 1966 coup, were recently offered for sale--but no takers. The Japanese estimate that it will take a year to convert the vessels. Meanwhile, a 10-man Soviet technical team is talking with the Government on several subjects, including the fate of the trawlers.

Idle Fishing Vessels

The Norwegian firm holding a management contract for SFC has loaned it about US\$340,000 to purchase spare parts for repair and maintenance of 7 idle Norwegian-built fishing vessels. SFC also is buying 4 new British-built fishing vessels; 2 will be delivered soon. Ghana hopes to have 10 vessels seaworthy by the end of 1968. (U. S. Embassy, Accra, Aug. 1 and 10.)



South & South-West Africa

SHOAL FISH CATCH IN
FIRST HALF REPORTED

Division of Sea Fisheries data show the following Cape west coast shoal catch for the first 6 months of the 1968 and 1967 seasons:

	Jan.-June	
	1968	1967
	.. (Short Tons) ..	
South Africa:		
Pilchards	100,404	74,730
Maasbanker	1,365	8,940
Mackerel	44,587	153,095
Anchovy	137,217	169,635
Red-eye herring . . .	14,671	13,966
Total	298,244	420,366
South-West Africa:		
Pilchards	489,924	491,429
Maasbanker	54	100
Anchovy	63,635	6,098
Total	553,613	497,627

Catch of 2 Factoryships

Also, the 2 South African factoryships took 393,883 tons of pilchards for the first six months in 1968. ("The South African Shipping News and Fishing Industry Review," Aug. 1968.)

* * *

REACH FISHING AGREEMENT

South Africa and South-West Africa have agreed that no new South African factoryships will be licensed to operate in the latitudes off South-West Africa. No new licenses will be granted for exploitation of fishing grounds off South-West Africa, either by shore-based companies or factoryships, unless research proves that the present South-West African fishing industry would not be harmed. (U. S. Embassy, Pretoria, Aug. 10.)



South-West Africa

PLANS SILOS FOR FISH MEAL PELLETS

The South-West African fishing industry has requested permission to erect silos for pelletized fish meal at the Walvis Bay harbor. The silos will store fish meal for bulk shipment.

The factoryship "Suiderkruis" was very successful in pelletizing and bulk-handling fish meal. This led the local industry to seriously consider introducing a similar process in land-based factories to reduce or eventually eliminate the bagging of fish meal. ("The South African Shipping News and Fish Industry Review," July 1968.)



Morocco

FISHING INDUSTRY DEVELOPMENTS

The Moroccan Office of Exportation and Commercialization (OEC) has reported an improvement in canned fish exports. By the end of the 1967/68 fish export campaign June

Morocco (Contd.):

30, OEC was left with only a normal reserve stock of 500,000 unsold cases. Last year, on the same date, OEC had a stock of over one million cases. Sales progressed or remained steady in the usual markets for Moroccan fish, except in Germany where Moroccan exports ran into strong Italian competition. The U. S. absorbs about 2.6% of Moroccan fish exports.



Fig. 1 - Unloading sardines at Safi, Morocco. (Photo: J. Belin)



Fig. 2 - Typical purse seiner used to catch sardines.



Fig. 3 - Great quantities of fish are unloaded daily in Agadir. Part is processed in relatively new factory that produces fish-meal both for animals and people. In 1966, some went to school feeding program of UN/FAO World Food Program. (Photo: A. Defever)

Modernizing Industry

The government is very interested in modernizing its fishing fleet, installing cold-storage and freezing facilities at the principal fishing ports, consolidating and improving fish canning procedures, and expanding fish exports. The new 5 Year Plan has allotted about US\$250,000 from public funds for fisheries development. Private investors are expected to contribute over \$1 million. (U. S. Embassy, Rabat, Aug. 20.)



Senegal

EXTENDS TERRITORIAL SEA AND CONTIGUOUS ZONE

On July 17, Senegal extended her territorial sea from 6 to 12 nautical miles with a contiguous zone of another 6 nautical miles. The contiguous zone will not affect the rights of parties to the 1958 Geneva Conventions that effectively enforce Convention provisions.

Expanding Fleet

Pressure to extend the limits came from the National Bureau of Fisheries and Oceanography. The Bureau was anxious to ensure adequate supplies of tuna, sardinella, rouget, and sole for Senegal's expanding fleet. The fleet should number 34 tuna-freezing vessels by 1971. (U. S. Embassy, Dakar.)



Togo

STRIVES TO IMPROVE FISHING

Thousands of people live from fishing along the 75 miles of Togo's coastal belt. Their baits, equipment, and methods are primitive and their catch small. Mechanized fishing is at its beginning. When the sea is rough, the small local boats cannot cross the bar or land safely.

Fish is one of the most important sources of animal protein for the people of Southern Togo. The government has received FAO help to improve fishing.



Fig. 1 - FAO expert examines fish from a locally built drier.



Fig. 2 - Togolese fishermen removing fish from their nets.



Fig. 3 - Beach seining is a popular Togolese fishing method. The large net is dragged in by a team of fishermen.

(FAO/C. Bavagnoli)



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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.



UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES



BCF Participates in International Trade Fairs



Foreign tradesmen have an opportunity to discuss availability, price and other pertinent information regarding U. S. fishery products with representatives of the BCF Office of International Trade Promotion. Full-time, proficient, multilingual interpreters are on duty at each fair. Several U. S. products first introduced at international trade shows are now firmly established in the European market. For further information, write to the Office of International Trade Promotion, Branch of Marketing, Bureau of Commercial Fisheries, 1801 N. Moore Street, Room 410, Arlington, Virginia 22209.

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COVER: Fish net on BCF's research vessel 'Albatross IV'
is set out during snow storm on fishing banks south of
Nova Scotia. (Robert K. Brigham)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.



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FISH-FLOUR COOKIES AT U.N. A U.N. staff member gives Mark Allen of United Kingdom a taste. Arthur Goldschmidt, a U.S. delegate, brought the cookies and protein-enriched soft drinks.

The Economic and Social Council, discussing the world's protein shortage, stressed that protein was needed most by growing children.

A report before the Council warns that lack of protein threatens 300 million children with retarded growth and possible mental damage. ("The New York Times")

U.S. FISHERMEN LANDED ABOUT 4.1 BILLION POUNDS IN 1968

In 1968, the fishermen of the United States landed approximately 4.1 billion pounds with an exvessel value of about \$442 million--an increase of about 80 million pounds and \$5 million above 1967. These are preliminary figures.

The catch of fish used as food decreased; the catch of fish for industrial products increased.

Exvessel prices for most species increased, but there were notable exceptions as a result of foreign competition.

The total U.S. supply of fish and shellfish set a record because imports increased significantly.

MENHADEN

Landings of menhaden increased more than 180 million pounds. This reversed the downward trend of 1967, when the 1.2-billion-pound catch was the lowest since 1951. However, landings did not reach those of the peak period, 1959-62, when over 2 billion pounds were taken each year. The greatest increase in 1968 took place in the Gulf; it was followed by the Chesapeake and Middle Atlantic States. Menhaden were nearly one-third of total landings of fish and shellfish in 1968.

SHRIMP

The most valuable U.S. fishery--shrimp--grew stronger. Demand was relentless and

prices rose through 1968. The catch topped the 1967 record by a small percentage. This resulted primarily from Alaska's expanding fishery and, to a lesser extent, Maine's.

The catch from the Gulf of Mexico, the most important shrimping area, decreased from 1967's high volume. The value of shrimp to fishermen, much higher than that of any other species, was about \$100 million--a drop of about 3% from 1967. Production of canned and breaded shrimp increased. The canned pack was the greatest since the 1930s.

ALASKA'S SALMON

The Alaskan salmon fisheries recovered from the disasterously low production in 1967. The canned pack was nearly doubled. The catch rose over 100 million to about 240 million pounds. Most of this resulted from the catch of more pink salmon. Because the salmon catch in Washington and Oregon fell, the overall increase in U.S. salmon landings rose only 80 million pounds in 1968.

TUNA

The tuna fleet, exclusive of the Puerto Rican part, caught 30-35 million fewer pounds in 1968 than in 1967. The exvessel price increased slightly over the 1967 price, so overall value of the landings to fishermen went up.

The catch of albacore and yellowfin was higher, skipjack's was cut in half, and that of

bluefin was at about the 1967 level. Albacore were in good supply in the north Pacific Ocean. Landings in Oregon set a State record.

The U.S. canned pack of tuna (including Puerto Rico's) processed from domestic landings and the catch by foreign nationals was about at the 1967 production level of 20 million standard cases.

PACIFIC HALIBUT

The Pacific halibut fisheries fared poorly. Although frozen inventories in early 1968 were not excessive, competition from imported fish products created problems. Compared with the 1967 period, lower prices for Pacific halibut prevailed throughout virtually the entire fishing season. Exvessel prices were lower in May, when the fishing season in major waters opened, and fewer vessels participated. Although prices increased during latter 1968, the fishing season was just about over.

The U.S. and Canadian catch from the convention area was around 49 million pounds (dressed weight). This was 9.5 million pounds fewer than the quota and the lowest since 1935.

The Canadian catch was 59 percent, the highest proportion taken by the Canadian fleet in this century.

U.S. landings of approximately 20 million pounds (equal to about 27 million pounds live weight) were more than 30 percent less than in 1967. They were the lowest since the recording of annual landings data began in 1915.

NEW ENGLAND LANDINGS

Compared with 1967, 1968 landings at principal New England ports declined less than 1 percent in volume--and rose 9% in value. The high exvessel value of sea scallops accounted for most of the increase in total value.

The catches of important species, except sea herring, that increased were: flounders, whiting (silver hake), and cod. Combined, these increased over 16 million pounds and \$1 million. Of the 3, cod alone dropped in exvessel price--down 13%. The other volume species, haddock and ocean perch, fell 28% and 12% in quantity, and 15% and 13% percent in value. The catch of yellowtail, the most important species of flounder, increased 23% and its value 20%. Landings of fish for industrial use in New England were up 10% in volume but down 1% in value. The canned pack of Maine sardines, from domestic and imported sea herring, was the greatest since 1954; it was over 200,000 cases above the 1967 pack of 1 $\frac{1}{4}$ million standard cases.

ALASKA'S SEA SCALLOPS

The development of Alaska's sea scallop fishery was noteworthy. Throughout most of 1967, BCF, State agencies, and industry conducted experimental fishing. Then, in January 1968, commercial production began. By October, 8 vessels were fishing: 4 converted vessels from the northwest Pacific Coast, and 4 transfers from New Bedford, Mass.

Sea-scallop landings topped 2 million pounds of edible meats with an exvessel value of over \$2 million. A record trip was set for all ports when one vessel on an 11-day trip landed 68,000 pounds. Despite a sea-scallop scarcity in Atlantic fishing areas, principally off New England, Middle Atlantic and Chesapeake States, landings exceeded 1967's low production of 10 million pounds of edible meats. High prices were principally responsible for the higher catch: average exvessel price soared over 50% above 1967's. At New Bedford, Mass., the main Atlantic Coast port, converted and new vessels entering the scallop fishery increased the fleet to at least 44 by year's end. This was the largest fleet fishing sea scallops in recent years. Also, some boats at other Atlantic Coast ports, as far south as North Carolina, took part.

ALASKA'S KING CRABS

King crabs were scarce and landings were only about 85 million pounds. This species, fished extensively in recent years, peaked in 1966 at 159 million pounds. The 1967 landings were 128 million pounds. Late in 1968, exvessel prices increased over 250 percent above those of a year earlier. These prices were a strong incentive for increased fishing effort.

DUNGENESS CRABS

Dungeness crab production set a record of nearly 50 million pounds, more than 12 million above 1967 and about 4 million pounds above the 1948 record. Because king crabs were scarce, some vessels shifted to the Dungeness

crab fishery. This produced a record Alaskan catch of nearly 16 million pounds, about 3 million above the previous high in 1964.

BLUE CRABS

Blue-crab landings were far fewer and prices substantially higher than in 1967. Blue crabs were scarce in the Atlantic coastal area. Major catch decreases occurred in the normally high-productive Chesapeake Bay area. Because of the high exvessel price, fishing increased in virtually all areas. Although overall catch fell about 30%, its value to fishermen was near the \$8 million they had received in 1967.

GREAT LAKES

In 1967, for the first time in the Great Lakes fisheries, coho salmon (1.5 million pounds) taken from Lake Michigan were sold commercially. The 1968 commercial catch was slightly greater.

FOREIGN TRADE

Imports of fishery products--in volume and value--set records in 1968. The declared value was about \$795 million. In 1967, the figure was \$709 million. In 1966, the previous high year, it was \$720 million.

Fish meal, a valuable ingredient in animal feed, comprises the bulk of nonhuman food imported. Its imports increased more than 150,000 tons above 1967's record of 651,000 tons. Greater shipments from Peru and, to a lesser extent, Chile, were responsible.

The quantity of imported fishery products for human food was nearly 1.7 billion pounds -- up from 1.5 billion pounds in 1967 and 1.6 billion pounds in 1966. Nearly all commodities gained. Among these were all species of fresh and frozen marine and fresh-water fish, including fillets and blocks, frozen tuna, fresh and frozen northern and spiny lobster, and canned sardines. Canned tuna was up slightly. Shrimp products were imported at about the 1967 high volume, but the percentage of raw peeled and canned meats increased, while raw, shell on, headless decreased.

Receipts declined for such canned products as bonito or yellowtail, oyster meats, crabmeat, and lobster meat.

Exports of domestic fishery products for human food were down over 20 million pounds from 108 million pounds exported in 1967 and 110 million pounds in 1966. Salmon, principally canned but also fresh and frozen, fell most. Canned squid shipments were about the same, and canned sardines were up only slightly from 1967.

Exports of menhaden oil through September 1968 dropped to about half the quantity shipped from U.S. ports in January-September 1967. Exports of menhaden oil in 1967 were 76 million pounds.



UNITED STATES

State of U.S. Fisheries Outlined by BCF Director

Speaking at "Fish Expo" in Boston, Mass., on October 16, H. E. Crowther, BCF Director, outlined "The State of Our Fisheries." The text follows:

Some of us in the Bureau of Commercial Fisheries are often asked by the press to comment briefly on the condition of the U.S. fishing industry. I am concerned each time this is asked of me because it is difficult to give a precise answer.

Our so-called domestic fishing industry is not a single entity. It is made up of as many segments as there are fisheries--each an industry within itself. Even the segments have parts or sectors, such as the producers (fishermen and boatowners), the processors, and the distributors. Also, processors and sellers of imported products are part of the U.S. fishing industry. Each segment and part has its own interests and problems and these may differ widely. The present condition of our fisheries or their sectors varies from record prosperity to severe depression.

During the past year many writers have pointed out repeatedly that the United States has fallen from second to sixth place in world fishery production. This fact usually is cited as if it were a disgrace for the United States to be in this position. In my opinion, our rank in world fisheries production is much less important than the economic condition of our fisheries. If it could be said that our domestic fishing industry had found it economically possible to expand its production to supply the U.S. demand for fishery products, I would be satisfied, even if we ranked 25th as a fisheries nation.

Unfortunately, we have not expanded our production. We have less than 7 percent of the world population, but we consume about 11 percent of world fishery production. Our per capita utilization of fish has increased almost 100 percent since 1957. We have the most attractive fishery market in the world, yet we supply less than 30 percent of the U.S. demand from the catch of our vessels. Of even more concern is the apparent trend in

production. Our domestic catch has dropped nearly 20 percent by weight since 1960. Yet, under these conditions some of our fisheries have flourished. This is further evidence that our fisheries are separate industries. Let us take a look at the present condition in some of our established fisheries from the point of view of the producer and the processor.

PRODUCER

Here in New England some of our major segments, such as the haddock fishery, find it difficult to operate at a profit. The resource on Georges Bank, on which the industry depends heavily, has suffered from a series of years of poor spawning survival. The last successful spawning (1963) which could have carried the haddock industry through the later years of poor survival was hit hard by the massive Soviet fleet just when the fish were large enough to be caught. In the market place, as well as on the fishing grounds, New England producers are facing severe competition from imported fishery products and from domestic food products.

In the Middle and South Atlantic area in 1967, the menhaden industry experienced one of its poorest years. A severe resource problem caused by poor survival due to unknown environmental causes or overfishing, or both, tied up vessels and closed plants. In addition to having limited quantities of fishmeal to sell, menhaden producers faced a market flooded with imported meal and a severely depressed market for oil.

The Gulf of Mexico brings a completely different story. For the first time in history a U.S. fishery (for shrimp) brought \$100 million to fishermen. The year 1967 was the best ever for our shrimp industry. Not only was the resource in good shape, but the market continued to expand in spite of relatively high prices.

For the tuna industry of the Pacific Southwest, 1967 was one of the most successful years on record. Although the yellowfin tuna fishing season was shortened by the regulations imposed by the Inter-American Tropical Tuna Commission, the U.S. industry succeeded in landing over 71,000 tons of yellowfin tuna and 60,000 tons of skipjack. The tuna

industry is an example of a segment of our fishery which overcame its foreign competition through improved efficiency.

In the Pacific Northwest, in 1967, the halibut industry began to feel the effect of incidental catches of halibut by foreign and domestic trawlers. Although the trawlers were seeking other species, the massive volume of their catches, especially by the foreign vessels, meant that millions of young halibut were caught and did not survive. Since halibut do not enter the longline fishery until they are 8 or 9 years old, the effect of the incidental catch was delayed in appearing. Along with reduced catches, prices of halibut were down, so this industry did not have a successful year in 1967. No improvement is evident thus far in 1968.

In Alaska, 1967 produced one of the smallest packs in the history of the Alaska salmon fishery through the unique and unfortunate coincidence of low cyclic abundance of all species--and in virtually all districts. But 1968 was much better because of a near record run of pink salmon which is expected to produce a pack of nearly 2,000,000 cases, compared to a meager yield of 345,000 cases in 1967.

In the Great Lakes area, we saw the inexpensive alewife dominate the fisheries, while in other inland areas, the remarkable catfish farming industry continued its rapid growth.

While our older, established fisheries were experiencing success mixed with failure, some new fisheries appeared, and other comparatively new ones expanded. The new Alaska scallop fishery continues to attract attention because of the high rate of catch and the price of the product. Catches of more than 45,000 pounds of shucked scallops in 10 days--at a landed price of over \$1 per pound--would be attractive to nearly anyone. Whether the resource is large enough to sustain this level of fishing is the question scientists are asking.

Another relatively new scallop resource--the calico scallop in the South Atlantic--continues to look promising. It may turn out to be a resource equal to that of shrimp in the Gulf and South Atlantic.

A large hake resource in the Pacific Northwest and an untapped thread herring popula-

tion in the Gulf of Mexico are waiting to be harvested.

Off the coast of Maine, the new shrimp fishery continues to produce and show promise. The tanner crab fishery in Alaska continues to expand to make up for the reduced abundance of king crab.

These and other new fisheries have contributed to the total U.S. catch. Had it not been for their development, U.S. production would have declined even more. Over the recorded history of U.S. fisheries, the catch has been maintained only by constantly seeking new species or new stocks. Resource after resource has figured prominently in the catch and later dropped to a position of minor importance. Thus, the U.S. fisheries have barely held their own by shifting to new resources as the yield of older fisheries diminished. Yet, while our catches have remained static or declined over the past 10 years, foreign vessels have taken more and more fish off our coasts. In 1967, the foreign catch in waters adjacent to our coasts was estimated to be about 7 billion pounds, which is more than the total U.S. catch.

The established and new fisheries referred to are composed of only a few of the species which make up the total so-called U.S. fishing industry, but they represent a fair cross-section. From these few examples I think it should be clear that it is impossible to generalize regarding the condition of our industry.

On the other hand, although segments of our fisheries vary greatly in many respects, some of the problems they face are identical:

1. Many are feeling the effects of declining resources due, at least in part, to foreign competition.
2. A number are plagued with resource failures due to problems which we as a nation have brought on ourselves. Pollution, destruction of estuaries, and overfishing are taking their toll of some of our fishery resources.
3. Some are finding it increasingly difficult to compete with imported fishery products as well as a variety of attractive protein products from other domestic sources.

How can we solve these major problems?

1. The problem of foreign competition for the resource is difficult. However, in the near future we must find a solution. By some means, some type of international management system must be put into effect, and the special interests which coastal nations have in resources off their coasts must be protected. Many people are at work trying to find a solution to this problem.
2. Resource failures, even within our own waters, will never be eliminated completely as long as we harvest wild species which depend on favorable oceanographic conditions for their survival. But we should be able to prevent resource destruction caused by the unwise acts of man. When our public becomes fully aware of and is sufficiently concerned about the effects of pollution and the destruction of estuarine areas, action will be taken. Whether this will come soon enough to save many species of fish is anyone's guess.
3. Foreign competition in some of our markets can be met by only two methods: (a) some form of assistance to the domestic industry to compensate for subsidies by foreign governments and/or (b) lowering the cost of producing domestic fishery products. Possible means of reducing costs center around mechanization of locating, harvesting, and processing procedures--and elimination of economic barriers, such as illogical regulations, which hamper the production of domestic fishery products.

PROCESSOR

In common with the producer, the processing segment of our industry has no single answer to its problems. However, processors are generally in much better shape than producers. Their position is much more flexible in regard to supply of raw material and in prices paid for fish and received for their finished products. But even within the same fishery, some processors are enjoying profitable operations and find ready markets for their products at acceptable prices, while others find it difficult to move their products at a profit.

Some processors operate modern, efficient, and well-managed plants that are comparable with the best in any other food industry in the United States. They produce products of a quality anyone would be proud of. Other processors of fishery products cannot boast of the same efficiency, and the quality of their products leaves much to be desired. In many cases, quality is sacrificed for profit. This type processor tends to tarnish the image of the entire fishing industry, weakens the demand for fishery products in general, and eventually puts himself out of business.

Has there been any improvement in quality over the past few years? I am sure there has, for more and more companies are producing better products. But there are still inferior products on the market. Unfortunately, even a small percentage of poor quality products hurts the entire industry, for it creates uncertainty in the mind of the consumer. Eliminate this uncertainty, and we will see per-capita consumption rise. Perhaps this can be done through development and promotion of an identification shield used by processors dedicated to quality. However, I am afraid that the only certain method is through mandatory inspection.

Millions of pounds of fish are inspected each year under the Bureau's (BCF) voluntary inspection program, paid for by processors packing inspected products. Fishery products produced by these companies are of high quality when they leave the plants. However, the program has one shortcoming--it cannot be used by the entire industry. For only those plants producing a substantial volume can afford the inspection program. So far, we have tried unsuccessfully to find a formula which would make the voluntary inspection program available to small plants. We are still trying.

If mandatory inspection of fish and fishery products should come to the United States, and most of us believe it will, we can expect hardships for some companies and some vessel owners. But, if the mandatory inspection program is a reasonable one, and the industry can weather the first few years of its operation, there is no doubt that the entire industry will benefit.

At this point, let me mention that some few fishing vessels and some few processing plants are not the only ones responsible for

quality loss. I am disturbed when I see how fresh or frozen seafood is handled in some distribution outlets. When I see fishery products stored at temperatures far too high to maintain proper quality, I think of the quality control that went into it at the plant, only to be neutralized by carelessness at the point of distribution. Any program designed to insure wholesome and high-quality products for the consumer must include all steps in product handling from the point of capture until it is in the hands of the consumer.

NEW PRODUCTS

When we look at the price and the demand for fishery products today, we find an unusual situation. Some luxury products, such as king crab and shrimp, are enjoying unprecedented demand. Even with substantial price increases, demand exceeds supply. But, while some luxury products enjoy this success, our "bread and butter" products such as groundfish are in trouble. There have been many explanations for this. Perhaps it is the quality, the flavor, the effect of promotion, the ease of preparation, or the desire of the consumer for something new in food that has influenced demand. Perhaps all of these have had an effect. Whatever the reason, I think this gives us a clue for future success. In my opinion, one of the greatest potentials in the industry is product development. Not just a slight modification, but a new product developed from our low-priced fish, such as cod and whiting, or from some underutilized species, such as herring and hake. Some will say it is not possible. I do not agree, for all of these species have the basic ingredients needed for an excellent food. The protein of such fish is unequaled and the texture is desirable.

I predict that in time a completely new fishery product will be developed--one that is such a "natural" that it will be accepted immediately. In this era of unbelievable technical developments, who can say that this is impossible? There is no doubt in my mind that it is possible! In my opinion, a highly acceptable product is waiting to be developed,

and when it comes along we will say, "Why didn't I think of it?"

Who will develop these products? So far Government has stayed out of this type of research, except by special invitation from a specific segment of an industry facing a particular problem. If the fishing industry can do the job, it should. If industry cannot handle it alone, perhaps it should call the Government for assistance. As far as my position as Director of the Bureau of Commercial Fisheries will permit me to do so, I offer a proposal. We are prepared to join you in seeking new types of fishery products--products which will allow us to upgrade some of our lower-priced species or use some of the unutilized raw materials off our coasts. We will join you in efforts to produce a luxury-type food product that will be in demand. By join, I mean a joint effort between industry and Bureau staff. Together, we have an excellent chance for success.

One final thought. I am annoyed when I hear the "fishing industry" referred to as a sick industry. It is true that some segments are in trouble, in many instances through no fault of their own. But, as I mentioned earlier, some parts of our industry are progressive and profitable. It is possible that our entire industry could be upgraded if we could properly identify the problems it is facing, and then propose effective solutions. To do this, the Bureau is suggesting a Master Plan for Commercial Fisheries, which we hope would become a joint effort of industry (producers and processors), States, Universities, the Federal Government, and any organization interested in fisheries. Soon we will arrange meetings with all groups who have an interest in a particular fishery (such as the New England groundfish) to attempt to reach agreement on program priorities. The plan is too complex to explain in the limited time available, but it will be published soon and described at future meetings. By seeking the advice of those who have worked in or with each segment and part of our industry, we should be able to make real progress in charting our course for the future.



Plan to Overcome World Hunger Outlined by 'American Assembly'

The world's rapidly increasing population will reach 6 to 7 billion by the year 2000. Breakthroughs in food technology--the development of new, high-yield seeds, for example--make it possible to feed such a large population. But serious food shortages in the remaining years of this century can be prevented only if 2 decisive forces are brought to bear simultaneously on the problem: reduced population growth and increased food production in the world's hungry nations.

This was the theme of the 34th American Assembly, which met at Arden House, Harri-man, New York, Oct. 31-Nov. 3, 1968.

The American Assembly, an affiliate of Columbia University, was established by Dwight D. Eisenhower in 1950. It conducts nonpartisan meetings and publishes books illuminating important issues of U.S. policy. The latest Assembly was attended by 73 persons from agriculture, law, business, government, education, communications, the military, the clergy, and other fields. The participants included some of the Nation's leading authorities on food production and population problems. They reached general agreement on a final report.

Their Report Summarized

The following is a summary of their report:

Because death rates have declined dramatically--without corresponding drops in birth rates--the world's population will double by 2000 A.D. More food, especially more protein, will be needed to provide nutritionally adequate diets. In the next 25-30 years, the developing nations will need at least a 4% annual increase in food production.

There is hope that the population by 2000 A.D. can be fed with present technology and continuing research. "But the necessary widespread and effective application of this technology will require major economic, social and political changes in developing countries, and a much larger scale of effort. Such

efforts must be accompanied by continuing, concerted and expanded assistance from advanced nations."

Probably for the remainder of the century, most of the increased food eaten by the world's population will come from farm land; most of the food needed by nations with booming populations will come from their own agricultural resources.

The essential elements to eliminate world hunger are:

- "Effective measures to reduce population growth;
- Effective measures to increase food production in hungry nations, and to assure its effective distribution to all persons in the population of each country, with interim food aid from advanced countries;
- Economic, political and social changes in developing countries designed to promote total economic development, without which the above cannot be achieved; and
- Substantial assistance toward all these objectives by the advanced countries."

Recognizing these objectives, the 34th American Assembly went on to emphasize that "effective action is urgently needed now." It recommended the following:

- Programs to reduce population growth should be expanded immediately. Only the success of these and other programs can prevent civil disorder and political collapse. Reductions in population growth rate "are as important in fostering economic and human development generally as they are in reducing the strain on national food supplies."

The present birth-control programs in developing nations should be broadened and new programs begun that emphasize voluntary family planning. The UN and its agencies should assume leadership in these efforts.

- It is urgent that national and international research efforts be coordinated and

expanded. These must focus on the obstacles to increases in productivity and profitability of most crop and animal species in most developing countries.

- The advanced nations should help the developing nations to achieve large increases in:

1. Availability and use of "inputs" into production--improved crop varieties, particularly with higher protein content and quality, water, arable land, and fertilizer, pesticides, and machinery produced locally where possible;
2. "Protein consumption from low cost sources such as fish and oil seeds, as well as livestock and poultry";
3. Enrichment of foods with essential minerals and chemically produced nutrients (vitamins & amino acids);
4. Government and private investment in marketing and processing systems to move food from farm to all countries.
5. Private and public communication media to inform producers and consumers.

- To achieve at least the 4% annual increase in food production, the amount of money (and its effectiveness) invested in developing the economy should be increased greatly.

- The food aid to hungry nations should not retard their agricultural development. Emphasis in the future should be on improving nutrition through more protein and sound economic growth--and less on the amount of food and surplus crop disposal.

- International trade and monetary policies should be changed to foster economic growth in all countries. They should enable developing nations to earn foreign exchange through trade rather than through grants and loans.

- Qualified technical personnel are needed in food production, marketing, and distribution to improve nutrition. "In the long run, first-rate national institutions in each country should meet these needs." U.S. universities can make a unique contribution.

- Hungry nations should provide strong incentives for farmers to adopt production-increasing techniques--incentives such as price guarantees, subsidies, improved seeds, fertilizer, and insecticides.

- To intensify farm production, local and foreign industry should supply critical goods and services.

- "The United States should press for international arrangements to insure that the oceans, outside reasonable territorial limits, be available for the use and benefit of all mankind. We acknowledge the importance of marine products as a source of protein and we urge continued and accelerated research on its economic feasibility and consumer acceptance. It should be emphasized, however, that for the remainder of this century at least, most of the increased food consumed by the world's people will come from farm land."

- The search for new plants and possible uses of wild animal life should be pushed. Playing useful roles are the research centers that are assembling and classifying valuable plant and animal genetic material useful to produce new and improved foods.

- Farmers of developing nations should be encouraged to set up cooperatives.

- All segments of the American public should be made aware of the accomplishments of U.S. foreign assistance--"and of the need for continuing and greatly enlarged commitments of resources to this purpose in the future."

- The U.S. and other nations should give more support to the United Nations and other international institutions in their dealings with agricultural development and population growth.



BCF Defines Continental Shelf Fishery Resources

BCF has identified certain shellfish, crustaceans, and sponges as resources of the U.S. Continental Shelf. These include: tanner, king, and stone crabs; red and pink abalone; Japanese abalone; queen conch; and 4 kinds of sponges.

H. E. Crowther, BCF director, notes that this list is the first of a series. The series will be based on studies being made by BCF scientists and will include other marine animals important to U.S. fisheries.

"Bartlett Act"

A 1964 Federal law, the "Bartlett Act," describes fishery resources of the Continental Shelf as those which, at the harvestable stage, "are immobile or are unable to move except in constant physical contact with the seabed or the subsoil of the Continental Shelf." Under the law, foreign-flag vessels may not take species so defined by the Secretary of the Interior from the U.S. Continental Shelf--except as provided by law or under international agreement to which the U.S. is a party. This definition also is used in the 1964 Geneva Convention on the Continental Shelf; the U.S. is a signatory.



Good Pacific Albacore Season Ends

A series of intense fall storms, some reaching down to southern California, high winds, and heavy seas forced almost all boats fishing albacore to return to their home ports by the end of October 1968, reports BCF La Jolla. Oregon set a new production record in 1968 with more than 41 million pounds of albacore landed--surpassing the 1967 record of 29 million pounds.

Total albacore production for Washington, Oregon, and California will be near 54-56 million pounds. This will make 1968 one of the top 4 years since 1940. Up to the last week in October, Oregon's share was about 76% of the total Pacific coast catch. This reflected a major geographic change in the center of albacore availability.

More Fishing Effort

Although the 1968 catch suggests near-record fishing conditions, this was not the case, say the La Jolla scientists. More fishing was done than in 1967--especially by halibut and salmon boats moving into the tuna fishery because they were having poor seasons. Albacore tuna schools were reported widely scattered this season with very few

usual fishing "signs"--"few jumping or breezing fish, few porpoise, few birds, scarcity of bait-fish schools, etc."

Jigboats fared reasonably well, but baitboats reported trouble finding "school fish" that would take live bait. Live bait was scarce in the Pacific Northwest. Many baitboats resorted to trolling and chumming jig lines with frozen and salted bait--rather than make long runs to southern ports where live-bait supplies were adequate. Unfavorable wind and sea conditions also contributed to poor baitboat catches during most of the season, and seriously hampered purse-seining.

Change in Fishery

A price dispute early in the season probably cost the industry about 2 weeks of good fishing in late June and early July. All pre-season survey evidence available to La Jolla's Fishery Forecasting group pointed to the earliest appearance of albacore tuna off southern California in the past 3 years. Also, the center of the fishery moved into Oregon-Washington waters. This forced most of the albacore fleet to unload in ports that did not have enough facilities to handle this year's catch. Unloading delays became a major problem during the season's peak in August. About 1 week of prime fishing time was lost to each boat discharging fares in northern ports. Also, while awaiting their turn to unload, some boats that rely on ice refrigeration lost much poundage to deterioration.



Lake Michigan Alewife Catch Declines

The expected 1968 commercial production of alewives from Lake Michigan is about 25 million pounds. It was 42 million pounds last year. Only half the pound nets used in 1967 were operated this year--and there was a corresponding 50 percent drop in pound-net catch.

The reduction in nets was caused by closing of 2 of the 3 fish-meal plants.

Commercial landings of alewives from Lake Michigan since the fishery began in 1956 were:

Year	Pounds	Year	Pounds
1956	400	1963	5,396,000
1957	220,000	1964	11,743,000
1958	1,356,000	1965	14,007,000
1959	1,264,000	1966	29,002,000
1960	2,370,000	1967	42,000,000
1961	3,195,000	1968	1/25,000,000
1962	4,742,000		

1/Estimated figure.



Deepwater Traps Yield Record Landing of New England Lobster

The "Homarus" recently landed more than 10,000 pounds of live lobsters at Gloucester, Mass., a record for a single trip. The trip lasted 8 days; one day's fishing time was lost to bad weather. Fishing began daily with first light and did not go beyond 4:30 p.m.; there was no night fishing.

The Homarus is operated by Deep Deep Ocean Products of Gloucester, which began fishing in May 1968. A second company vessel, the "Red Diamond," recently began fishing. Prior trips by company vessels had not landed more than 5,700 pounds.

"Delaware I" Explored

Successful gear trials and exploratory fishing conducted by BCF's Gloucester Exploratory Fishing Base in spring-summer 1968 demonstrated the harvesting possibilities of this type of fishery. One good experimental catch was made by BCF's Delaware I June 12 on the slope between Shallop and Veatch Canyons in 109 fathoms. Using a string of 11 pots, 89 lobsters weighing 158.5 pounds were taken in 24 hours, an average of 14.4 pounds per pot.

Experimental catches exceeding 4 pounds of lobsters per pot for fishing time of 24 hours or less have been made between 63 and 109 fathoms at various locations, primarily near heads of canyons along the outer edge of Georges Bank. Experimental rectangular trap gear used measured: (1) Type A--40"x60"x18"; (2) Type B--36"x48"x18".



U.S. Agencies Will Act Quickly When Oil Is Spilled

President Johnson approved on Nov. 13, 1968, a Federal interagency plan to produce quick, united action when oil and other hazardous materials are spilled in U.S. waters. The plan was signed in September by the heads of Interior, Transportation, Defense, and Health, Education, and Welfare.

A National Joint Operations Center for Oil and Hazardous Materials Water Pollution Incidents has been set up at Coast Guard Headquarters in Washington, D.C. It will coordinate Federal action when major spills of oil and other hazardous materials occur. Representatives of the 4 departments will be available at the center when needed.

LBJ Cites 'Torrey Canyon'

President Johnson gave "dramatic and tragic examples" of the damage from oil pollution. He cited the sinking of the oil tanker Torrey Canyon off Britain in 1967--and the tanker "Ocean Eagle" off Puerto Rico in March 1968.

In March, Mr. Johnson asked Congress to hold financially liable the owners and operators of ships and shore facilities for the full cost of cleaning the oil pollution they cause. The Senate and House passed different bills and the legislation died.

When approving the interagency plan, the President said the legislation should be a "high priority item" for the next Congress. He emphasized the "urgent" need for new authority to prevent oil pollution--and to require polluters to pay for their damage.



Japanese Water-Pollution Study Team Visits

A Japanese water-pollution study team visited the U.S. Department of the Interior in Washington, D. C., in November before leaving on a 10-day tour of the U.S. The visit was part of the U.S.-Japan Cooperative Program in Natural Resources.

The program includes studies of common problems concerning "water, air, energy,

wind and seismic damage, undersea technology, and agricultural problems." It began in 1964 with the U.S.-Japan Committee on Trade and Economic Affairs. In October 1967, a U.S. study team of water-pollution experts visited Japan. Other Japanese experts also have visited the U.S.

Team and Tour

Leading the 5-man team was Dr. Kenichi Hanada, Chief, Water Pollution Control Division of the Government Resources Research Institute, Tokyo. Experts of Interior Department and the Department's Federal Water Pollution Control Administration explained the U.S. water-pollution-control program.

After Washington, the Japanese inspected advanced water treatment and research facilities and conferred with officials in Cincinnati, Ohio; Chicago, Ill.; and Portland & Corvallis, Ore.



U.S. Proposes Conservation Measures in Northwest Atlantic

The U.S. announced on Nov. 14, 1968, proposed amendments to regulations on the size of meshes in trawl nets used in the northwest Atlantic fisheries. The proposals were published in the "Federal Register" on Nov. 6 and the public given 30 days to comment.

The amendments followed recommendations of the 14-member International Commission of the Northwest Atlantic Fisheries (ICNAF). All 14 governments, including the U.S., agreed to the changes.

The Changes

The changes extend mesh-size regulations to more species and to previously uncovered areas of northwest Atlantic. New species include ocean perch, halibut, grey sole, yellow-tail flounder, Greenland halibut, pollock, white hake, black back sole, and dab.

H. E. Crowther, BCF Director, said extension of U.S. fishing efforts into new Atlantic areas necessitated protection of resources by extending conservation measures. He added that other ICNAF nations are adopting new regulations. (See Canada, p. 75.)



Fishery Products Affected by Airlines' Rate Increases

United Airlines and American Airlines have filed increases in general commodity rates on shipments under 1,000 pounds ranging to 120%, effective Jan. 1, 1969. These will affect fishery products.

Interior Secretary Udall protested the increases and requested an investigation. The National Fisheries Institute (NFI) filed a protest on Nov. 14, 1968.

Other air carriers also are considering rate increases on small shipments.



Catfish Farmers to Meet

Catfish Farmers of America will hold their First Annual Convention on February 7 & 8, 1969, at the Fontainebleau Motor Hotel, in New Orleans, Louisiana.



Consumer Near Coasts Eats More Seafood Than Inlander

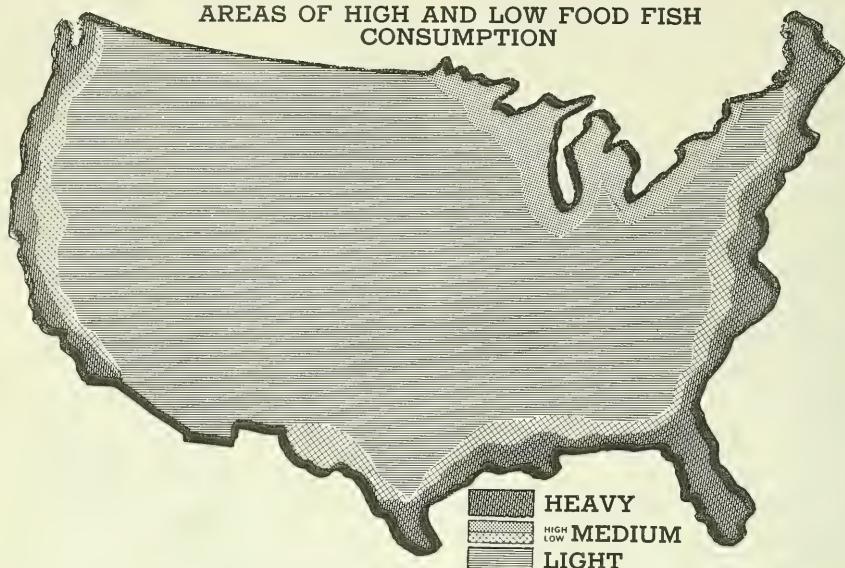
Year after year, the U.S. consumer eats between 10 and 11 pounds of fish and shellfish. While quantity has remained much the same, the kinds of seafood eaten have changed significantly. Canned tuna has soared in popularity and canned salmon has declined. Per capita consumption of shrimp has increased, but that of oysters has declined. Prepared and packaged fishery products have multiplied to meet the demand of housewives for seafoods that involve virtually no work.

Regional Differences

Where the consumer lives largely determines how much seafood he eats. If he lives near the coasts, he eats more seafood than the person in the interior U.S. (See chart on p. 14.)

BCF and industry are developing processing methods to enable inland areas to receive better-quality fish and shellfish. BCF is investigating irradiation of fishery products to determine whether fresh fishery products can be kept fresh longer on grocery shelves. Air shipments have increased.

AREAS OF HIGH AND LOW FOOD FISH CONSUMPTION



First All-Aluminum Shrimper Will Fish Gulf of Mexico in 1969

The world's first all-aluminum shrimp trawler, an 83-foot craft, will be built by Graham Boats of Pascagoula, Miss., and go to work in the Gulf of Mexico in summer 1969. This was reported by the Aluminum Company of America.

Charles Graham, president of Graham Boats, explained why he chose aluminum for the boat:

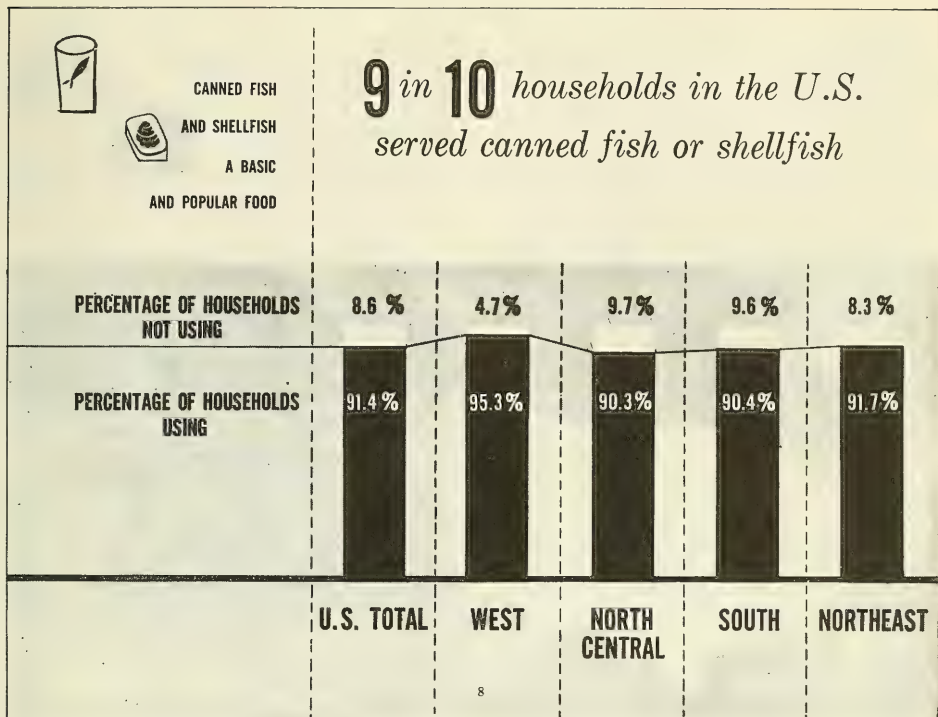
"Use of aluminum will result in lower operating costs and permit faster speeds both en route to fishing grounds and homeward-bound with a full load. We won't have to paint or sand blast the boat, thereby reducing maintenance costs. Under peak load conditions, the boat will require less draft than a steel or wood unit. Further, we can safely predict a much longer life for the craft."

The new shrimp boat will be refrigerated and thus permit it to remain in the Gulf for extended periods while maintaining highest product quality. Air-conditioned quarters and pilot house will provide relief to shrimper crews who often work in temperatures of 100 degrees or more. The boat will carry the latest electronic navigational aids. It will be operated by Gulf City Fisheries, Inc., also headed by Graham.



Canned Fish or Shellfish Served in 9 of 10 U.S. Homes

Most U.S. families eat canned seafood, an important protein food. Fish contain about 18 percent protein, which is highly digestible and often recommended in diets for old people. Fish supply 5-10% of the nation's animal protein for people.



Large amounts of canned fish or shellfish are eaten in every part of the U.S., although the kinds differ from region to region.

Good Food

The fats in fish are polyunsaturated, which many researchers believe is important in the human diet. The percent of fat in different fishes varies: from less than 1% for the cod family to 20-25 percent for salmon or mackerel.

Canned fish and shellfish are good sources of B complex vitamins. These include thiamine, riboflavin, niacin, vitamin B₆, and vitamin B₁₂. They also contain useful amounts of calcium, phosphorus, iron, copper, and iodine.



New England Landings April-June 1968 Reported

Groundfish and sea scallop fished by New England fleets during April-June 1968 have been reported by R. L. Schultz and F. A. Dreyer of BCF's Woods Hole (Mass.) Biological Laboratory:

Haddock

Haddock landings from Georges Bank for the first 6 months of 1968 were off about 15 million pounds, and landings per day declined about 3,200 pounds, compared to the 1967 period. This decline in haddock landings and abundance was due to a scarcity of scrod.

Scrod abundance for April-June 1968 dropped 57 percent from 1967, a result of poor recruitment from the 1964 & 1965 year classes.

Large-haddock abundance in April-June was nearly a thousand pounds ahead of 1967. These larger fish were remnants of the strong 1963 year class.

Age compositions showed 1963 year class still predominant, and the importance of the 1962 year class all but ended. The absence of 3-year-olds in the catch suggested the reason for low scrod landings.

Landings and landings per day for Browns Bank haddock were running about the same as in 1967. Large and scrod abundance showed little change.

Yellowtail

Yellowtail landings in first-half 1968 were running about 4 million pounds ahead of 1967. Both Georges Bank and Southern New England grounds were producing higher landings.

Abundance increased on Southern New England grounds compared to second-quarter 1967. Georges Bank yellowtail abundance also was higher. The level of effort on both grounds, though high, was still below previous peak years. With this high abundance of yellowtail and no change in effort, 1968 landings could end close to 65 million pounds.

Age compositions on both grounds showed very strong 1964 and 1965 year classes dominating the landings. It was expected that the success or failure of the 1966 year class would influence the continuance of this increasing trend of yellowtail abundance in 1969. The 1964 and 1965 year classes should continue to contribute substantially to the fishery in 1969.

Cod

Cod landings for the first 6 months of 1968 were about 3 million pounds higher than the 1967 period due to a daily increase. It was difficult to ascertain whether this reflected an increase in true abundance. With haddock relatively scarce, changes in fishing pattern may have been influencing cod-abundance index.

Redfish

Schultz and Dreyer noted that "the state of the fishery for redfish was questionable, to say the least." Landings per day were higher on all grounds fished by the U.S. fleet, yet landings were about the same as 1967's. Obviously the fish were available, but lack of interest has resulted in a gradual shrinking of the fishery.

Silver Hake (Food Fishery)

The silver hake fishery appeared recovered from the 1966 & 1967 labor and price disputes. Landings were ahead of 1967 for the first 6 months. Landings per day were lower on Georges Bank and higher in the Gulf of Maine in 1968, but total abundance remained about same.

Industrial Fishery

Despite increases in red and silver hake catch per day, landings in first-half 1968 remained about the same as in 1967 period. Total industrial landings were running behind 1967. This decrease resulted mainly from reduced landings of species other than hake. These other species, eelpout and flounders primarily, have dominated industrial-fishery landings since 1966, when red and silver hake abundance declined drastically in Southern New England waters.

Sea Scallops

Sea scallop landings from the Middle Atlantic were slightly ahead of 1967 but still far below 1965-1966 levels. Georges Bank landings were very low for April-June 1968. The thing that seems to keep the fishery alive is the price of scallops to the fisherman (1.15-1.20).

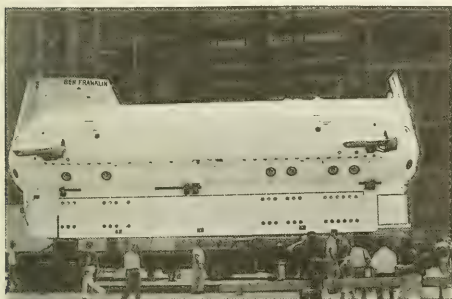
The 1967 "Albatross IV" survey showed an increase in scallop abundance. However, it failed to materialize in 1968 commercial landings data. Landings per day have remained low on both grounds.

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OCEANOGRAPHY

Drifting 'Ben Franklin' Will Carry Modern Equipment

When the research submarine Ben Franklin begins her Gulf Stream drift mission early in 1969, she will carry the most sophisticated scientific equipment available for oceanographic work. She will start at the Florida end of the Gulf Stream and, 4 weeks later, arrive at a point in the Stream off Massachusetts.



Grumman Aircraft Engineering Corp., Ben Franklin's owner and operator, developed the world's largest nonmilitary research submarine with the help of Jacques Piccard, an authority on deep-diving vehicles. The U.S. Oceanographic Office (NOO) provided most of the sub's scientific equipment. Also, it will send 2 or 3 oceanographers on the mission and provide the surface support ship.

The Mission

The scientists will drift with the Gulf Stream in the 50-foot, 130-ton sub. Data supplied to them by a current sensor system mounted on the top deck will enable them to measure the sub's relative current speed and diversion.

The vehicle has a 36-man-week life-support capability. The scientists will be able to view their surroundings from 2 external camera systems designed to provide stereo photographs of the sea floor--and two 70 mm. cameras integrated into a closed-circuit television system to observe marine life and

phenomena. Several bracket-mounted, hand-held, still- and motion-picture cameras will be used to photograph the scientists at work.

The scientists will use a narrow-beam, side-scan sonar to see the outline of the sea floor passed over by the sub. A continuous FM sonar system will monitor obstacles that may be encountered. It will observe and monitor the Deep Scattering Layer--horizontal, sound-scattering bands of marine life that often produce "false bottoms" on the recording traces of echo-sounding devices.

Special Equipment

The scientists will use a water-sensing pod to measure on magnetic tape continuous digital information on temperature, salinity, depth, and pressure of the water surrounding the sub.

A proton magnetometer will provide data on the magnetic field and local anomalies--irregularities in the magnetic field pattern. A transmissometer will measure the light absorbed by one meter of water. It may be able to determine the level of natural light with an ambient light meter, still being developed.

A turbulence measurement instrument is expected to determine fluid velocity by temperature change--and then produce a profile of the current shear (the whirlpool-like turbulence where 2 opposing currents meet) from top to bottom of the sub. An acoustic system will determine continuously the sub's total depth and the total water depth.

Although the sub is equipped with four 25-horsepower AC electric motors, she was designed to be propelled northward along the Gulf Stream by the current itself. This will provide the scientists with a noiseless research and observation platform. The Ben Franklin is expected to hover in midwater for "continuous observations of the same volume of ocean for the entire 4-week mission."

See article by Jacques Piccard, p. 53.



U.S. Exchanges Nautical Charts With Other Nations

The U.S. Naval Oceanographic Office (NOO) exchanges nautical charts on a continuing basis with 48 foreign nations, a 47-year-old tradition. Most of the 48 are members of the International Hydrographic Bureau headquartered in Monaco.

The world-wide exchange was proposed in London in June 1919 at a 25-nation International Hydrographic Conference. Delegates also considered the idea of exchanging "sailing directions, notices to mariners, light and buoy lists, tide tables and other hydrographic (charting and mapping) publications."

Began in 1921

The exchange of nautical charts and other hydrographic publications began in 1921 when the International Hydrographic Bureau, which resulted from the 1919 conference, went into operation. As the major U.S. ocean-charting agencies, NOO and the Coast and Geodetic Survey act for the U.S. in all official matters at the Bureau.

No country can chart the world's oceans covering 70% of the earth's surface. So the exchange, says NOO, provides an effective way for nations to learn the results of surveying activities by other nations.

A Case History

NOO noted that "16 reported dangers of various types" were included in the 1954 edition of a chart of the Gulf of Siam. But after a detailed survey in 1961-62 by the USS 'Maury' and 'Serrano'--2 NOO hydrographic survey ships--12 of the charted shoals were disproved and removed from Oceanographic Office charts.

This information was speeded to the International Hydrographic Bureau, which removed the shoals from its "Doubtful Hydrographic Data." As a result, NOO said, all nations in the Bureau learned that their mariners could "once again proceed (through the Gulf of Siam) on the most direct routes with safety and assurance."



Train Unemployed for Jobs in Oceanography

ESSA's "Explorer" has become involved in a new kind of discovery. She has been transferred to the U.S. Office of Education for use as a floating classroom to train "hard core unemployed" for jobs in oceanography. The 219-foot, 1,900-ton hydrographic survey vessel, launched in 1939, was decommissioned in January 1968.

The Office of Education said the vessel will be towed from Norfolk, Va., where it had been decommissioned, to a berth in Washington, D. C., by Ogen Technological Laboratories, Inc. The firm will establish the curriculum and provide instructors for the \$155,000 program. The ship will be berthed at the former Naval Gun Factory on the Anacostia River.

To Train 120 Youths

The Office of Education says the program is aimed at training 120 hard-core unemployed young men between 16 and 22 from the Washington area as oceanographic aides for positions in government and private industry. It is believed the first attempt to train the disadvantaged in oceanography. The 15-month program provides for classes of 40 hours per week lasting 8 to 10 weeks.



Nautical Charts Issued for Alaskan Arctic Coast

The Coast and Geodetic Survey (CGS) has issued 29 nautical charts of Alaska's Arctic Coast following the discovery there of major oil deposits. The large-scale charts are revised editions of those previously published by CGS for the Navy but classified until now. They are based on topographic and hydrographic surveys made from 1945-53 and 1961-62 and provide the most detailed coverage of this area.

What Charts Cover

CGS notes that the charts cover the remote coastal area extending from Point Hope east to the Canadian border. A revised edition of another once-classified chart has been issued for the Cape Romanzof area in western Alaska, south of Norton Sound.

The area covered includes Prudhoe Bay, where large oil deposits have been discovered; Scammon Bay, Point Hope, Marryatt Inlet, Cape Lisburne, Point Lay, Kasegaluk Lagoon, Icy Cape, Avak Inlet, Wainwright, Peard Bay, Point Barrow, Admiralty Bay, Smith Bay, Cape Halkett, Harrison Bay, Camden Bay, and Demarcation Bay.

The Cape Romanzof chart is numbered 9374. Those for the Arctic Coast are 9450 through 9478. They are published at a scale of 1:50,000.

CGS expects the new charts to provide a major assist in developing Alaska's mining and petroleum industries. They may be purchased for \$1 from CGS nautical chart agents in Alaska, or by mail from CGS, 121 Customhouse, 555 Battery Street, San Francisco, Calif. 94111.



Biologist Studies Dangerous Fishes

Dangerous marine animals, including fishes that bite and those that sting, are being catalogued according to species, environment, and geography by Florence Rieken, a marine biologist and oceanographer at the U.S. Naval Oceanographic Office (NOO).

As an example of what may be published when enough material is gathered, she said: "We are thinking about presenting updated information on shark attacks in a manuscript, which eventually may be compiled into a technical publication. The article not only would list the shark species known to attack man but also would give the geographic locations of shark attacks along with the seasons the attacks occurred."

Similar manuscripts may be prepared on highly venomous fishes, such as the stonefish and other reef fishes known to sting man. These also would list the species of venomous fishes, environmental factors, and geographic locations.

Sonic Fishes & Mammals

Mrs. Rieken also is compiling information on sonic fishes and mammals, such as porpoises, known to emit sounds, and on schooling fishes, such as herring.

The material on sonic fishes and mammals may be compiled into handbooks for Navy sonar men. Articles on schooling fishes may help sonar men. They would be able to use the environmental data to determine if echoes to sound signals are being returned from the schools or from a submarine. Eventually, the information on schooling fishes may benefit fishermen.

Asks for Data

Mrs. Rieken has completed filing the information she collected on dangerous marine and sonic animals. She asks that new data on shark attacks, and poisoning or stinging incidents by venomous fishes, be sent to the Commander of the U.S. Naval Oceanographic Office, Suitland, Maryland 20390, marked for her attention.



Scientists Prepare Worldwide Ocean Chart

The world's oceans conceal rugged terrain and scientists of the U.S. Naval Oceanographic Office (NOO) are charting part of it for the International Hydrographic Bureau. They will complete the project's first phase by January 1969.

The scientists are collecting depth measurements, from soundings, that reveal the ocean-floor contour for Pacific and Atlantic Ocean areas up to 2,000 miles off the North and Central American Coasts. In addition to NOO ships, they are using sounding data observed by naval and merchant ships.

These measurements, plus those collected by the U.S. Coast and Geodetic Survey for two areas--one in Pacific, the other in Atlantic--are the U.S. contribution to a scientific chart being prepared by the International Hydrographic Bureau to show the topography of the world's oceans.

The World Chart

The chart, "General Bathymetric Chart of the Ocean," will have 24 full-color sheets: 16 will provide coverage between the Arctic and Antarctic circles at a scale of 1:10,000,000; 8 at 1:3,100,000 will cover the 2 polar areas.

William Opalski, director of the NOO project, reported: "More than 900,000 soundings have been disseminated to foreign countries for use in the compilation of their plotting sheets for the world-wide bathymetric chart."

The Netherlands, Great Britain, Brazil, and France are coordinating their work with NOO.

The International Hydrographic Bureau has 42 member nations. It coordinates the work of hydrographic (ocean charting & mapping) agencies in its worldwide effort "to produce accurate navigation and scientific charts for mariners and scientists of all nations."



Ocean Bottom 'Profiled' by New Device

A device designed to outline the sediment layers that underlie the sea floor is being tested by scientists of the U.S. Naval Oceanographic Office (NOO), Geological Survey, and Princeton University. They are in the Caribbean aboard the 285-foot, 2,580-ton USNS "Kane," the Navy's newest oceanographic research ship.

The NOO scientists are using an acoustical profiler belonging to the Geological Survey to "investigate the cover of sediments over the substructure" of the Puerto Rican Trench between the Virgin Islands and Curacao.

The Profiler

The profiler, a "sparker," is housed in a mobile unit and is lashed in position to the Kane's upper deck. It is capable of discharging electrical shocks 15,000 to 20,000 feet into the sediment layers beneath the sea floor.

L. E. Garrison, a Geological Survey geologist, explained: "The acoustical energy bursts generated by the profiler are designed to penetrate the sediment layers. Portions of the sound 'sparks' are expected to be reflected from the layers, returned to receiving hydrophones towed 15 to 20 feet beneath the ocean's surface, and recorded on magnetic tape. Recorders can transfer the sonic echoes into graphic profiles that can be visually inspected. By examining the profiles, the scientists, hopefully, will be able to separate the sedimentary layers down to the ocean basement--the igneous or metamorphic rock complex underlying the sedimentary rock structure" that begins in the Puerto Rican Trench 27,000 feet beneath the ocean's surface.

M. W. Buell Jr., NOO oceanographer, stated that the information expected to be revealed by the profiles will be added to data gained from coring and will be "correlated with all the existing data." This information will be incorporated into Navy programs aimed at developing knowledge about the ocean and the sea floor.

Core Samples

Buell added that core samples dredged in the Caicos Island region of the Bahamas are being inspected "to see if the sediment age can be determined in an effort to gain a better idea of the history of the ocean floor." The scientists also are taking samples of the water column to learn more about "the circulation of the subtropical underwater and other significant water mass intrusions" into the Caribbean.

The 'Sparker'

The 'sparker' is capable of generating 200,000 joules (one joule equals one watt-second of energy). Later, when it is merged with the Kane's shipboard system, the 'sparker' is expected to produce 233,000 joules--"the hottest spark ever to be put into the ocean."



Foreign Fishing Off U.S. in October 1968

NORTHWEST ATLANTIC

In October 1968, 177 vessels from East and West Germany, Romania, and Spain were sighted, 8 more than in September.

Soviet: Sixty-seven different vessels were sighted--19 factory stern trawlers, 39 medium side trawlers, 2 factory base ships, 4 refrigerated transports, 2 repair tugs, and 1 tanker. Early in the month, they were concentrated 40-50 miles east of Cape Cod and Nantucket (Great South Channel) catching light-to-moderate amounts of herring. About mid-month, they shifted to areas 30 miles south of Martha's Vineyard and Nantucket, where catch was mostly whiting. A small group spent the month fishing herring on Cultivator Shoals.

Polish: The fleet--3 stern trawlers, 18 large side trawlers, 2 factory ships, and 1 cargo vessel--continued to fish more or less apart from other fleets. Except for one sighting of 23 vessels on northeast Georges Bank, only scattered vessels were observed off Cape Cod and Nantucket. Limited catches of herring were seen.

East and West German and Romanian: One Romanian freezer stern trawler, 38 East German, and 35 West German trawlers and support ships fished herring from 14-50 miles east of Cape Cod and Nantucket.

Spanish: An estimated 12 stern and side trawlers were seen pair trawling on the inner shoals of Georges Bank.

New Fishing Area

Twenty-four East and West German and 5 Polish vessels were sighted 20-25 miles east of Portsmouth, N.H. (Jeffreys Ledge). U.S. fishermen have been reporting foreign vessels there for several weeks.

Gulf of Mexico and South Atlantic

No foreign vessels were reported south of Cape Hatteras, or in the Gulf.

California

Soviet: Five vessels were sighted. Two factory stern trawlers and a refrigerated

transport were observed fishing about 25 miles west of Half Moon Bay, just south of San Francisco. A third stern trawler was sighted off the Klamath River south of the Oregon border.

Off Pacific Northwest

Soviet: Twenty-two large stern factory trawlers, 10 processing and support vessels, and 3 exploratory research vessels were sighted: half off Oregon and half off Washington. During the third week of October, most were fishing Pacific hake off Washington. For the third consecutive month, no medium side trawlers were seen; this indicated a Soviet switch to stern factory trawlers in the northeast Pacific.

Japanese: Two long-liners, 2 stern trawlers, and 1 cargo vessel were sighted. (The Japanese press recently reported that 7 trawlers in this area had taken about 50,000 metric tons.)

Alaska

Soviet: Forty-four vessels were sighted. In October 1967, the Soviets fished only ocean perch; this year they fished a variety of groundfishes. Early in the month, their ocean perch fishery centered along the Aleutians, with about 14 stern trawlers and 2 refrigerated transports. About mid-month, the effort shifted into the Gulf; by month's end, only about 5 stern and 2 medium trawlers, and 1 reefer remained off Aleutians.

Five medium trawlers and 1 reefer fished pollock, perch, gray cod, sable fish, and flatfish, just off Continental Shelf edge in central Bering Sea. About mid-month, 5-6 medium trawlers began fishing north of Fox Islands.

Japanese: The winter decline in fishing off Alaska continued; the number of vessels dropped from nearly 80 early in the month to just over 50 at the end. Still, this was more than twice the Japanese effort in October 1967.

The Gulf of Alaska ocean perch fishery was continued by 4-7 stern trawlers. One vessel, processing about 20 tons a day, was bringing 6 to 8 tons aboard in one drag. Three stern trawlers fished ocean perch along Aleutians, and 12 stern trawlers, with one factoryship, were active along the 100-fathom curve in eastern and central Bering Sea.



Fig. 1 - The refrigerated Soviet transport "Arkhip Kvindgi" (Sibir class) with SRTM 8-403 alongside transferring cargo. (Photo: Zahn)



Fig. 2 - Spanish fishing stern trawler "Villalba," owned and operated by a Vigo fishery firm.



Fig. 3 - A Japanese Danish seiner in eastern Bering Sea. A fleet of 12-15 accompanies a factoryship engaged in production of fish meal, oil, and minced fish meat. In photo, net has been fastened to working gear on foremast and ship is dead in water. (Photo: J. Branson)

The minced fish meat and fish-meal fleets in eastern and central Bering Sea--6 factory ships and 108 trawlers in late September--were reduced to 2 factory ships and 20 trawlers by late October.

The 2-fleet factoryship crab fishery in the eastern Bering Sea ended in October. The first fleet left early in the month; the second followed within 10-14 days. Japanese sources had reported that only 79% of the quota had been reached by mid-September, and that the fishery would have to be extended into October. Since only one fleet fished extensively in October, the quota may not have been achieved this year.

Five Japanese long-liners fished sablefish in the Gulf of Alaska throughout October 1968. One ship, boarded by a BCF agent, was taking about 5 tons daily--95% sablefish and 5% ocean perch.



STATES

Washington

FLOATING FPC PLANT BEGINS OPERATION IN PUGET SOUND

A surplus 196-foot Navy rocket ship has been converted into a floating fish protein extraction plant, the 'Cape Flattery I.' It is based at Neah Bay, Wash., on the Makah Indian Reservation.



The Cape Flattery I.

The plant uses the Vio Bin Corp. process: a solvent is mixed with the fish to extract the oil and water at low temperatures, producing a concentrated protein. The odorless processing aboard ship does not pollute the surrounding waters. The protein concentrate is blown to shoreside milling, storage, and bagging facilities.

The Cape Flattery I will use scrap fish--hake, ratfish, dogfish, and skate. It has the capacity to process 200 tons of fish daily.

For Animals First

At first, the Cape Flattery Co. plant will produce concentrated fish protein as a food additive for pets, fish hatcheries, mink breeders, livestock and poultry, and for industrial uses. Within 6 months, the process will be refined to produce FPC for human consumption. The FPC will be an odorless, tasteless powder that can be stored indefinitely. When added to rice, bread, corn, or other grain and liquid foods, it will provide a protein-rich meal.

U.S. Aid

The plant was financed partially through a \$650,000 loan from the Economic Development Administration (EDA) of the Commerce Department. Shareholders invested \$500,000. The Makah Tribe obtained a \$141,000 loan

and grant from EDA to finance construction of a tribal public dock. The new plant employs tribe members.

The former navy vessel was converted by the Marine Construction & Design Co. (Marco) of Seattle. The project began in December 1967 with the dismantling and moving by truck of a practically unused Vio Bin fish-meal plant from Greensport, Long Island.

* * *

3 VESSELS FISH PUGET SOUND HAKE

In late November 1968, 3 vessels--'Radio,' 'Wisconsin,' and 'Voyager'--were fishing for hake in Puget Sound. The Radio was landing its catches, to be made into pet food, at La Conner, Wash., the Wisconsin and Voyager were delivering to a fish-meal plant at Everett, Wash.

Total landings since this season began in October 1968 were about 1 million pounds. Since the fishery began in 1965, it has extended from September or October into May or June of the following year. Seasonal catches have been about:

	Pounds Landed
1965-66	6,200,000
1966-67	10,700,000
1967-68	8,160,000
1968-69 (To Nov. 21, 1968)	1,000,000

* * *

NEW BOOK ON CHINOOK & COHO SALMON

A forthcoming book by Washington Department of Fisheries marine biologist Sam Wright, "The Origin and Migration of Washington's Chinook and Coho Salmon," answers such questions as where these fishes go after leaving their home streams, who catches them, and with what gear.

Wright states that salmon from 2 different river drainages, and often stocks within the same river, rarely show identical patterns of fresh-water residence, downstream movements, growth, ocean dispersions, relative availability, upstream migrations, and

spawning preference. He bases his conclusions on marking and tagging investigations by Washington, Oregon, California, Alaska, and Canadian fisheries agencies.

Wright notes that 1 of 4 chinook and coho salmon caught in Washington waters during 1968 (and 1969) will be examined for missing fins or other markings by the Department of Fisheries. Caught salmon may carry a tag (disc or loop type) affixed early in their lives. They may have a very small, coded, magnetic-wire tag in the snout. Or, having been fed chemical compounds when young, they bear identifying "rings" on their bones.

Sport vs. Commercial?

He says the common opinion that sport and commercial fishermen compete directly for salmon is often not true. The commercial salmon trollers often fish isolated grounds outside the 1-day range of coastal ports. By the time ocean sport fishing reaches its maximum, many trollers have switched gear and are searching offshore waters for albacore. Also, many shallower, confined coastal waters are essentially sport fishing "preserves" because efficient trolling is not practicable.

As knowledge of salmon grows, Wright adds, rules about commercial net fisheries and fresh water sport fisheries become complex, often difficult to understand. This is simply evolution toward maximum economic and recreational use of each stock--plus the provision of optimum escapements to perpetuate the resource.

In Puget Sound, net and sport fishermen often operate in same area concurrently, but the fishes caught differ in size, maturity, and habits. Backbone of the sport chinook and coho catch is the feeding, immature fish that will strike the lure or baited hook. These fish offer good sport, but they would often have little commercial value. The larger, mature chinook and coho returning to Puget Sound streams have ended their active feeding by the time they reach inner Sound waters. So only a few of the many thousands passing through can be taken on sport gear. On many occasions when large hatchery-produced runs have passed through intense sport fisheries, only an insignificant number were taken.

Wright describes chinook and coho movements from several Pacific Northwest streams:

CHINOOK SALMON

Columbia River: Lower River fall-run chinook move northward and contribute to British Columbia troll fisheries off west coast of Vancouver Island; few are taken south of Central Oregon or north of Vancouver Island. Amazingly, the largest numbers occur off north Washington and in Strait of Juan de Fuca; fall-run chinook caught here are much more likely to be of Columbia River origin than those caught off mouth of Columbia itself.

Winter, spring, summer, and upriver fall chinook from the Columbia tend to migrate further north in much greater numbers. The indications are that many move offshore to feed in the Gulf of Alaska. Ocean catch distribution is around 75% off Alaska and British Columbia, and 25% off Washington.

Coastal Streams: Chinook from Washington coastal streams move northward; over 75% of ocean catch is off British Columbia and Southeastern Alaska. "Contrary to popular belief, only a small number are taken offshore of Grays Harbor."

Puget Sound: Fall chinook from its streams also move northward; a minor part goes south. The ocean catch is about 90% off British Columbia and Southeastern Alaska, 10% off Washington. However, large numbers remain inside Puget Sound for appreciable periods; these immature feeders contribute importantly to sport fisheries. When they move seaward, they are less available to the ocean fisheries than several other major stocks; a greater percentage escapes the ocean fishery and returns to Puget Sound--to be exploited by commercial net and sport fisheries.

COHO SALMON

Columbia River: Coho show pronounced movements to the north and south but the latter dispersion is dominant. Off Washington, they become steadily less abundant from south to north; abundance reaches a low north of Cape Flattery. The southward movement--more extensive and lengthy--makes these stocks vitally important to fisheries off California and Oregon. These fisheries depend on a single age class or brood year during each fishing season, so the annual catches fluctuate more violently than with chinook; there, annual

production is masked by the various ages and stream residence categories entering the catch.

Coastal Streams: Coho produced in Grays Harbor and Willapa Bay tributaries differ markedly from their nearby Columbia River counterparts. They disperse primarily to the north; ocean harvest is mainly in fisheries off central and northern Washington. Sizable numbers move off Vancouver Island and are exploited by the Canadian troll fleet. Returning adults enter the commercial net and river sport fisheries. The harvest of precocious males, or 2-year-old "jacks," reaches significant proportion only in the river anglers' creel.

Puget Sound: Again, significant coho migrations occur north and south in the ocean. Their abundance declines steadily from south to north along Vancouver Island's west coast and north to south along Washington. As a result, the catch is divided about equally between the fisheries of Washington and British Columbia. These stocks also contribute to Washington and Canadian net fisheries in the Strait of Juan de Fuca--and to Washington's Straits sport fishery and net and sport fisheries in inner Puget Sound. They differ markedly from other coho stocks. Many remain in Puget Sound and never migrate to sea; they form backbone of the sport fishery. The drainages nearest the available foraging (and fishing) areas often contribute most to the catch.

Wright concludes that it is possible to estimate with reasonable accuracy the major coho stocks contributing to Washington's salmon fisheries on an annual basis. Unlike chinook, the major stocks are much more likely to originate in drainage systems near each fishery. Several interrelated factors are responsible for this. On the average, cohoes spend much less time in the ocean due to their younger age at maturity, so their migration distance tends to be much less than the chinooks. They also show random dispersions to north and south, unlike the dominant northward movements of chinook. And, probably most important, their "catchability" or susceptibility to hook-and-line gear does not lessen as quickly as fall chinook approaching their home streams.



Oregon

RECORD SHRIMP CATCH

In 1968, 41 shrimp boats fishing off Oregon landed a record 11,000,000 pounds in Oregon ports, reports the Oregon Fish Commission. In 1967, 10.4 million pounds had set a record by a substantial margin. During the past 10 years, the annual average catch in Oregon waters has been only 3.5 million pounds.

Landings might have gone even higher in 1968 except for interruptions from bad weather and a cost-price squeeze in May, June, and July.

A very strong 1966 year class comprised well over 60% of the 1968 catch. It was the major contributor to the record.

The Shrimp Beds

Typically, shrimp beds are the green mud bottoms 4 to 20 miles off the coast. Beds off northern Oregon and near Coos Bay have been especially productive during the past 10 years.

In 1968, however, the Port Orford bed stole the limelight. It set a new catch-per-effort record for the Pacific coast, except for Alaska.

Coos Bay accounted for more than 4 million pounds. It was high port for 1968. Astoria landings were 2.3 million, and Port Orford's 1.3 million pounds. Newport landings, partly from a bed located during a Fish Commission shrimp cruise in spring 1966, reached 2 million pounds. Other significant shrimp beds are offshore near Brookings and Garibaldi.

* * *

SPRING CHINOOK HATCHERY RETURNS SET RECORD

In 1968, a record 41 percent of the spring chinook escapement over Willamette Falls returned to the Oregon Fish Commission's Willamette and Marion Forks hatcheries, reports Ernest Jeffries, commission fish culture director. Commission hatcherymen estimated the total return to the 2 hatcheries of 12,800 fish. In recent years, up to 30% of this run returned to the 2 stations.

Nearly a third of the estimated 31,500 spring chinook passing over the falls returned to the Willamette Hatchery alone, a remarkably high hatchery return for spring chinook.

10,000,000 Eggs

From the fish arriving at Marion Forks and Willamette, commission hatcherymen took more than 10 million eggs. The bulk of the spring chinook eggs are taken at the Willamette and Marion Forks hatcheries, and at 2 other Willamette tributary hatcheries, McKenzie and South Santiam. Together, the 4 hatcheries rear about 5 million spring chinook each year for release into the Willamette system.

Reason for Hatcheries

The Willamette and Marion Forks hatcheries were constructed by the U.S. Army Corps of Engineers to compensate for fish losses caused by construction of Detroit and Lookout Point Dams. The Corps provides the bulk of the annual operating expenses.



Alaska

OIL POLLUTION CONTINUES IN COOK INLET

"Oil pollution incidents continue to occur at an alarming rate despite the joint-pollution-control efforts by State and Federal conservation agencies," reports BCF Juneau.

On Oct. 23, 1968, a break in Shell Oil's pipeline from Platform "A" occurred on Middle Ground Shoal. It spread an estimated 1,000 barrels of crude oil over Cook Inlet waters off Kenai. The Federal Water Pollution Control Administration (FWPCA) reported the oil spread over an area 30 miles long and 6 miles wide. The pipeline, the

Inlet's oldest, has been the source of several oil spills in recent years.

9 Unreported Incidents

Also, surveillance and patrol flights over the Inlet during October 1968 by BCF, Bureau of Sport Fisheries and Wildlife, FWPCA, and the Alaska Department of Fish and Game revealed 9 incidents of pollution that had not been reported voluntarily by industry.

"The full impact of oil pollution on the important fish and wildlife resources of Cook Inlet is unknown," BCF Juneau states. However, in early October 1968, conservation officials picked up 115 guillemots and 4 murrelets along 6 miles of beach south of Anchor River. It was estimated that about 250 dead or dying birds could have been recovered. In addition, mallards and pintails taken in the Redoubt Bay area showed signs of exposure to oil pollution.



Texas

HATCHERIES PRODUCED 16 MILLION FISH IN FY 1967-68

Texas Parks and Wildlife Department fish hatcheries produced and distributed 15,942,693 fish during fiscal year 1967-68. This is 14 percent above the 13,986,413 fish in the 1966-67 fiscal year.

The cost of rearing and distributing each fish was 2.37 cents for the 1967-68 period, compared with 2.05 cents in the 1966-67 period.

Types and numbers of fish were: Black bass, 13,090,760; warmouth bass, 108,000; sunfish, 112,915; channel catfish, 2,191,388; flathead catfish, 2,100; black crappie, 97,675; white crappie, 49,530; hybrid sunfish, 226,675; and blue catfish, 63,650.





Cod end coming over rail of BCF's research vessel 'Silver Bay' during bottom-fish explorations off Florida. (Photo: J. B. Rivers)

BCF'S VERY LONG LINE

BCF casts a vibrant line that connects the commercial fisherman's catch in the ocean, gulf, and inland waters to consumers across the U.S. Strung along it are BCF responsibilities to find fish; devise the best ways to catch and keep them wholesome until port is reached; study the most economical ways of unloading, freezing, processing, and distributing them to the Nation's consumers; provide data to the industry on the kinds and prices

of fish, and where and when they are available, so that industry can make informed decisions; and provide information to the public ranging from price to preparation of fish.

BCF supplies loans to the fishing industry, helps train scientists, and connects the U.S. with other nations to protect several fisheries and the U.S. fisherman's interests.

Juneau

- POT-TYPE GEAR
for catching
'spot' shrimp

- DUTCH TRAWL

Seattle

- LARGE MIDWATER TRAWLS
- UNIVERSAL TRAWLS
- DEPTH-TELEMETRY SYSTEMS
- HAKE EXPLORATIONS

La Jolla

- FORECASTS ALBACORE
& BLUEFIN TUNA AVAILABILITY
- EVALUATE POTENTIAL
FISHERY RESOURCES
- DEVELOP UNDERUTILIZED
RESOURCES
- IMPROVE FISHING
FLEET EFFICIENCY



Vast Responsibilities

BCF's responsibilities begin with the inland waters and the sea. Its scientists sail aboard modern oceanographic vessels from Woods Hole, Mass., Miami, Fla., La Jolla, Calif., Seattle, Wash., and Honolulu, Hawaii, to study the physical quality of the sea and the plants and animals in it. They study species of fish off U.S. coasts and gather information on size of fish resources, rates of decline or increase, and the effects of large catches on a fish population.

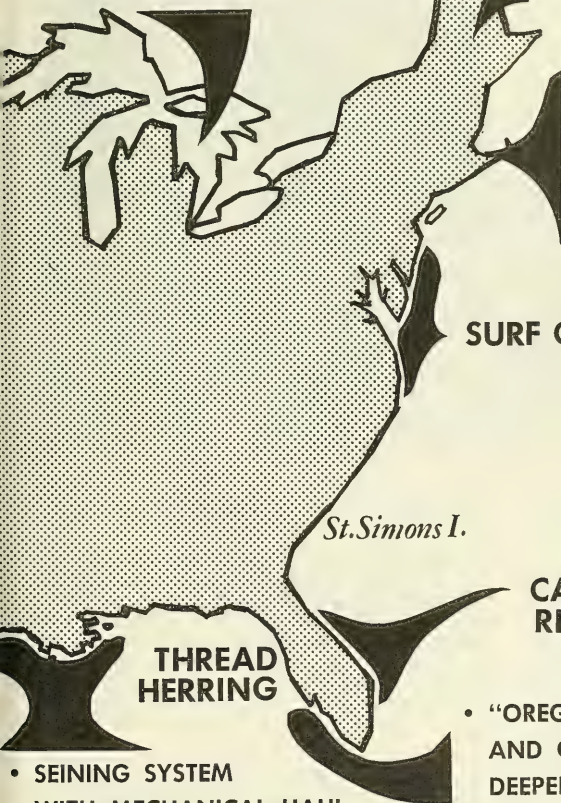
Achievements

BCF explorations have found unexploited stocks of fish and shellfish large enough for profitable commercial fishing; concentrations of sablefish, Pacific ocean perch, and hake off the Washington coast; shrimp beds in Alaskan waters, off South America's northeast coast, and brown shrimp off Florida's east coast; surf clam grounds off the mid-Atlantic coast; and chubs in the Great Lakes.

Arbor

ED INDUSTRIAL FISHERY

ALEWIVES WITH TRAWL SYSTEMS



• "DELAWARE" FOUND COMMERCIAL CONCENTRATIONS OF SHRIMP

- JEFFREYS LEDGE
- Gloucester*
- KING-SIZED LOBSTER POTS
- VACUUM EVISCERATOR
- SONIC INSTRUMENTS
- TIME-MOTION STUDIES

SURF CLAMS

St. Simons I.

CALICO SCALLOP RESOURCE

- "OREGON II" LOCATED TILEFISH AND GROUPER STOCKS IN DEEPER WATERS

THREAD HERRING

- SEINING SYSTEM WITH MECHANICAL HAUL TO HARVEST FARM-POND FISH

Pascagoula

When new sources of fish are found, BCF specialists study the type and size of vessel and gear most suitable for catching the fish. BCF's midwater trawl catches commercial quantities of formerly underutilized species; it is expected to expand fishing for the Pacific Coast fisherman. BCF improvements in the shrimp trawl may make daytime trawling profitable. Its scientists have used underwater television to develop gear and adapted the telemeter to midwater trawl fishing. They have used submarines and satellites.

On Shore

On U.S. shores, BCF scientists work to conserve the estuaries, where at least 7 of the 10 most valued commercial species and most marine sportfish species spend important parts of their life cycle.

The U.S. coastline is important to a half-million people whose living comes from commercial fishing--and to sport fishermen, waterfowl hunters, boaters, swimmers, and nature lovers.

EXPLORATORY FISHING & GEAR RESEARCH

Basic to the vast BCF operation are the exploratory fishing and gear research of 6 field stations at: Gloucester, Mass., St. Simons Island, Ga., Pascagoula, Miss., Ann Arbor, Mich., Seattle, Wash., and Juneau, Alaska. These centers publish their findings.

The following are some recent achievements of the field stations:

NORTHEAST & MIDDLE ATLANTIC

Along the edge of the Continental Shelf, king-sized lobster pots have proved effective in waters 10-15 times deeper than those fished by inshore lobstermen.

Time-and-motion studies aboard fishing boats have led to the development of conveyors and sorters that make the fishermen's job easier by eliminating bending and reaching.

A vacuum eviscerator replaces the "rip-and-grap" method. The new device, together with much-improved washing devices, reduces bacteria on fish and increases high-quality shelf life.



Fig. 1 - The vacuum evisceration technique.

A leakproof, insulated, nonreturnable container enables processors to ship fresh fish longer distances than ever before.

The "Delaware" explored for surf clams in the western Atlantic between the state of Delaware and False Cape, Virginia. She found large beds south of the existing commercial fishing areas.

Commercial concentrations of shrimp were found near Jeffreys Ledge south of Casco Bay. These boosted the Maine shrimp catch.

The Gloucester, Mass., staff developed an "independently powered sonic instrumentation system" to give shipboard recordings of the fishing performance of New England otter trawls. The staff measured the trawl nets of several commercial vessels during fishing operations. The measurements may help increase catches.

GREAT LAKES

BCF researchers helped the industrial fishery for alewives in the Great Lakes with new trawl systems. They also designed an

electrical trawl device for harvesting alewives. Test catches were 28% higher than those of ordinary trawls.

Increased commercial harvest--and introduction of salmon--may reduce alewife die-offs and restore the fish population balance.

BCF is conducting programs to promote the growth of the catfish industry: "gear and harvesting research, technological development, quality improvement, and Federal aid programs."

Its researchers have developed a mechanized haul seine to harvest catfish effectively. It works well with conveyor equipment used to load fish into trucks for shipment. The seine is efficient in large and small ponds down to 8 feet.

GULF & SOUTH ATLANTIC

BCF vessels discovered thread herring stocks in the Gulf of Mexico. Its staff is cooperating with industry in the northeastern Gulf to promote a new industrial fishery for this and other sardinelike species.

BCF's new "Oregon II" located stocks of tilefish and groupers in the Gulf's deeper waters.

Other Bureau vessels have found concentrations of calico scallops off Florida's east coast in 3 areas between New Smyrna Beach and Fort Pierce. Interested groups are trying to start a commercial fishery.

PACIFIC NORTHWEST

BCF exploration determined the areas and abundance of Pacific hake. This helped the commercial fishermen make good catches.



Fig. 2 - Nylon haul seine developed by BCF is stacked on pontoon barge and ready to set over stern roller. It is used in harvesting catfish from farm ponds.

Demonstrating Seine

During first-quarter 1968, 10 harvesting demonstrations with the mechanized seine were run in farm ponds in the Arkansas-Mississippi delta region. More than 200,000 pounds of fish were taken from 340 acres.

A truck-mounted line hauler is being tested "to develop a safe, efficient, and compact harvesting system."

BCF is providing information on plant design and sanitation to new processing plants in Arkansas and Mississippi. It is gathering data on the present and potential markets for catfish.

BCF-developed large midwater trawls and a precision depth-telemetry system are used by industry. The trawls have contributed to record catches of hake.

A "universal" trawl that can fish at midwater depths--and on the bottom--has tested well.

ALASKA

Researchers sought the most efficient pot-type gear for catching large-sized "spot" shrimp, the best bait, and best time period for pots to fish. Their fishing-gear trials led to a small commercial pot fishery in Southeastern Alaska.

They also tested a Dutch trawl, which has an upper and lower bag. Bottomfish and debris enter the lower bag--and shrimp the upper bag. Test fishing was encouraging: no shrimp were caught in the lower--and no bottomfish, crab, or debris in the upper. This trawl may become a useful device in the fishery for small pink shrimp.



Sonar Studies Pacific Skipjack Tuna

The scientists of BCF's Honolulu (Hawaii) Laboratory are conducting an unusual and far-reaching investigation; Not to find a fish, or a school of fish--but the population of a small tuna, *Katsuwonus pelamis*. It is called skipjack tuna in English and aku in Hawaiian. It is caught around the Hawaiian Islands throughout the year. The best catches have been made in summer when schools of large fish appear. Carefully kept records for the past 20 years show that 53 percent of the average annual catch of 5,000 tons is made in June, July, and August. Annual catches have ranged from 6 to 16 million pounds.

It has seemed probable to the lab's fishery scientists that, in addition to the local skipjack tuna, the Hawaiian fishery is drawing upon a migrant population--one that visits the islands in greatest numbers in summer. The scientists have concluded that these "season" fish are part of a large population resident in the central Pacific Ocean.

They assume that one of main spawning grounds of the skipjack tuna is south and east of Hawaii in the equatorial central Pacific. Fish spawned there migrate to the west coast of central America and Mexico; there several thousand tons of young fish are harvested annually. Within a few months, the scientists' assumption is, the skipjack turn westward again, returning to the central Pacific.

Several lines of scientific investigation led to this hypothesis. They pointed to the probability that the central Pacific has a very large population of skipjack tuna--and the only fishery there, in Hawaii, takes only a minuscule amount.

The Honolulu scientists forecast a yield of 100,000 tons if this skipjack population can be fished. That catch would be worth about \$25 million a year to the fishermen,

\$62.5 million after processing, and \$100 million at retail level.

The Operation

The lab was charged with the basic scientific studies required to bring this great resource into production. It equipped one of its research vessels, the "Townsend Cromwell," with a "complex, sensitive, and powerful electronic device, a continuous-transmission, frequency-modulated (CTFM) sonar to study the movements of tunas in the water." The sonar emits a sound signal whose reflection by a solid object--a tuna or tuna school--permits the operator to plot the ship's distance and direction from the object. The sonar resembles radar: the radar signal is an electromagnetic wave, but the sonar uses sound waves.

Complementing the sonar is a 14-channel electronic device that records the sonar's information. These data are automatically converted for analysis on large computers. So a tuna becomes "an echo picked up by the sonar (appearing on sonar screen as a point of light), a number in analog form on magnetic tape, a number in digital form on another magnetic tape and, eventually, Arabic numerals on a computer printout."

What They May Discover

With such information, says John C. Marr, BCF's Hawaii Area Director, the scientists will be able to determine the ways tunas move about. Now, most knowledge is obtained from sightings by fishermen when the fish ascend to the surface in pursuit of prey. "How long the schools remain at the surface, to what depths they descend, whether they maintain a schooling formation at night, how long a school lasts as a school (some scientists believe it may be throughout the lives of the fish), the routes they travel in the central Pacific--all this information, and more, will become available."

So far, most of the work has been done in Hawaiian waters because the operators of the equipment have been getting used to it.

Sonar Detects Sonic Tags

The scientists also are using the sonar as passive equipment. They are listening for a special sound: one emitted by a "sonic tag," a small sound transmitter attached to a

fish. The tag now being used is 3 inches long and an inch in diameter. It broadcasts a sound pulse every second. The scientists have used the tag on little tunny (kawakawa) and on a shark. They were able to track the shark for 18 hours, the little tunnies for shorter periods. They hope that development of the tag will enable them to track tuna schools through the depths for longer periods.

By determining the behavior of individual tunas and tuna schools in Hawaiian waters, the BCF scientists expect to gain the information they need to design gear that will make possible the development of this great potential resource.



BCF Has Only U.S. Drift Buoy Program

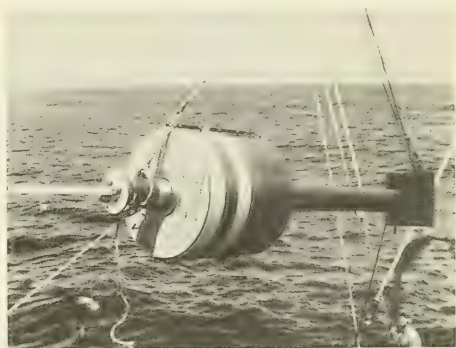
BCF has the only drift buoy program in the U.S. The program will operate from the Bureau's Seattle, Wash., Biological Laboratory with 7 operational buoys. One buoy is completely equipped with communications features that would have provided data transfer through the NASA NIMBUS satellite--but the satellite was lost at launch. The buoy now is on standby. Equipped with 8-10 sensors and the telemetry equipment needed for satellite communication, it costs about \$60,000.

Needed for Program

The Seattle scientists explain the need for a drifting buoy system; Oceanographic surveys describe general patterns of circulation and distribution of water properties and organisms. However, such environmental conditions as gradients, and maximum and minimum values of water properties, can be more important to life in the sea than absolute values taken at one time and place, or seasonally biased average values. No reasonable expenditure of ship time, money, and manpower is likely to provide the detailed, 3-dimensional, synoptic, physical-chemical-biological coverage of the ocean required for marine fishery research. This is the reason BCF has developed its drifting buoy system. There is no doubt that most of the volume data gathering in the oceans will come from moored and drifting buoys--transistors turn out to be far cheaper than vessels. This application releases vessels to be used for other functions that cannot be instrumented.

The Buoys

Currently, 2 buoys are instrumented to measure temperature, depth, and salinity--and to telemeter data to research vessel or shore laboratory by HF telemetry link. The accuracy of measurements that can be expected from the sensors on these buoys is plus or minus 0.05° C. for temperature, and plus or minus 0.05 parts-per-thousand salinity. The accuracy with which the drifting buoys can be located is within 5 miles under optimum conditions, but it can range up to 30 to 50 miles when the buoys are far from shore. With satellite positioning, the accuracy is expected to be plus or minus ½ mile.



BCF Telemetry Buoy.

Sensing Units

The sensing units are inductively coupled to the cable attaching them to the buoy and contain their own power supply. A programming unit within the buoy samples the sensors on remote command from shore, or according to a pre-set schedule. Data are recorded on magnetic tape in binary format for transmission when the buoy is interrogated. A 25-watt transmitter, with power pack capable of up to one-year operation, transmits the data in response to a coded tone sequence.

Navy's TRANSIT System

Participation in TRANSIT, now the Navy Navigational Satellite System, is under consideration. Under this system, satellite orbits any buoy positions will be tracked at Seattle. When there is a favorable pass, the buoy will be switched to receive the satellite signal. Doppler shift will be received,

counted, digitized, and transmitted on inter-rogation. All satellite orbital control, re-fraction correction, and computation will be conducted at the land station--and only relatively inexpensive receiving and counting equipment will be required on each buoy.

Instrumented Buoy Tested

A 30-day operational test of a fully in-strumented buoy began Sept. 13, 1968, when the BCF research vessel "George B. Kelez" placed a buoy in Puget Sound. The buoy was anchored for purposes of the test. This test, only partially successful, was designed to determine the capability of new sensing units to provide data on water temperature and salinity at depth. It pointed out the need to correct equipment deficiencies.

Seattle Program's Future

As the scientists look to the program's future, they visualize buoys placed at random in the Gulf of Alaska and southward along the coast from Alaska to Washington. Eventually, the buoys will be placed according to a fixed plan.



Fish Pump Will Improve Brailing Operation

In the California wetfish (industrial) fish-ery, brailing--transferring catch from purse seine into vessel's hold--seems costly in time and labor. Many foreign fisheries use pumps to replace the brailing operation.

To aid the wetfish fishery, BCF's Fishery-Oceanography Center at La Jolla, Calif., has bought a rebuilt Marco Capsulpump. The pump will be installed in several California seiners for short trial periods.

Improvements Sought

The BCF researchers hope to demonstrate that mechanization of brailing "can permit a reduction in crew size, an appreciable saving in time, and a superior condition of the fish." The pump should enable 3 men to handle 100 tons of fish per hour; without the pump, 4 men haul about 25 tons an hour.



Like Finding A Fish in the Ocean

In July 1968, G. F. Kelly and C. F. Bocken of BCF's Woods Hole (Mass.) Biological Laboratory, went on a field trip to Eastport, Maine. Their purpose was to sample the population of redfish and to examine any tagged fish that might be caught.

Although they saw many tagged redfish in the water, most of the 250 caught were untagged. But one had been tagged in July 1956! During 12 years of freedom, the fish had been recaptured 3 times before.

It had grown 8 cm.--a rate of about $\frac{3}{4}$ cm. a year. The fish was in excellent condition and was returned unharmed to the water.



Woods Hole Aquarium Draws Record Crowd

During the 86 days it was open to the public this summer--June 15 to Sept. 8--the BCF Woods Hole Aquarium received a record crowd of 267,200 persons. This is 7,000 more than the record set in 1966. Average daily attendance was 3,130.



BCF-Produced Film Wins Award

The motion picture "Mullet Country" won a silver award at the International Film and TV Festival of New York on Oct. 18, 1968. The film was produced by BCF with funds provided by Florida under Public Law 88-309.



TV Documentary to Include Miami Lab's Shrimp Culture

Experiments in shrimp culture conducted by BCF's Tropical Atlantic Biological Laboratory (TABL) in Miami, Fla., will be seen on TV this winter in the American Broadcasting Co. series, "Man and his Universe." The ABC crew visited TABL October 7 and 8 and filmed aquaculture scenes inside the lab and the shrimp grounds nearby.

Florida's Calico Scallop Resources Are Evaluated

The calico scallop beds off Florida's east coast are "too dynamic," says BCF's Branch of Exploratory Fishing, to be able to find commercial concentrations consistently in the same area. Maximum concentrations are distributed between the 15- and 25-fathom depth contours from Fort Pierce to slightly above Daytona Beach.

No Definitive Pattern

The area has no "definitive pattern"--except that scallops occur in bands and patches.

Each patch reaches commercial size and maximum yield at different times. These depend on depth, probably influenced by water temperature, and north-south distribution.

1,200 Square Miles

The size of the calico-scallop bed is estimated at 1,200 square miles. In any month, 5-20% of this area has commercially exploitable stocks.

"The estimated growth rates of scallops are rapid and the life cycle short. The factors causing and affecting spawning, distribution, and mortality are matters of speculation at this time."



Fishermen on BCF research vessel "Silver Bay" prepare to dump catch of calico scallops on deck during exploratory drags off Florida. (Photo: J. B. Rivers)

'Albatross IV' Studies Bottom-Dwelling Invertebrates Off Northeast Coast

A major recent project of the scientists of BCF's Woods Hole (Mass.) Biological Laboratory was a cruise aboard the Albatross IV to the Gulf of Maine-Georges Bank region to study the benthic (bottom-dwelling) invertebrate communities. The localities they sampled most intensively were in relatively shallow (15-60 meters) rocky-bottom areas off Maine and Massachusetts, western Nova Scotia, and deeper areas near Browns and Georges Banks.

Benthic fauna samples were collected primarily with a 1-meter naturalist's dredge-- and at selected communities with a sea-scallop dredge, quahog dredge, and bottom skimmer. Bottom sediments were collected with a pipe sampler. The vessel occupied 243 stations so the scientists could collect samples of marine life and sea water for analysis aboard ship or back at the Woods Hole lab.

Rich Communities Found

The scientists came across more than 15 communities of benthic invertebrate animals. Some of the richest and most varied were in rocky areas along the Maine Coast, off western Nova Scotia, and near Nantucket Shoals.

"Sponges, tunicates, sea anenomes, starfishes, hydroids, and other organisms were present in enormous quantities in these localities. Dense beds of small bivalve mollusks (*Astarte* spp., *Venericardia borealis*) were common in muddy bottom areas along the Maine Coast. Swarms of amphipod crustaceans were present on Stellwagen Bank and Nantucket Shoals. Vast areas dominated by polychaete worms (*Potamilla neglecta* and *Onuphis conchylega*) were encountered off the northern Massachusetts coast and southwest of Nova Scotia."

Much Information Acquired

Woods Hole staff sorted, classified, counted, and weighed 60 samples from the Albatross IV cruise. The results add much to previous faunal studies of this region. The scientists say that when all collected materials have been analyzed "there will remain only a few gaps in mapping of the benthic invertebrate communities in the offshore Gulf of Maine region."



'Albatross IV' Surveys Sea Scallops of Georges Bank & MidAtlantic

The sea scallop stocks of Georges Bank and the Middle Atlantic region were surveyed in September 1968 by Albatross IV under the supervision of Henry W. Jensen, BCF Woods Hole. On Georges Bank, most of the scallops sampled were 4 or more years old. One to 6 bushels per 10-minute tow were taken at scattered locations on eastern Georges Bank.

On Southern Georges Bank, most scallops were large, 6 years and older; there was no evidence of recruitment of younger scallops. Catches averaged less than one bushel per tow.

Near Hudson Canyon, commercial-size scallops were not very abundant and were mainly 5 years old and older. These were caught at a rate of less than one bushel per 10-minute tow. A moderate number of 3 and 4-year-old scallops were caught. This suggests sufficient recruitment of young scallops to support commercial fishing for the next 2-3 years.

Comparative tows were made using the standard 10-foot scallop dredge with 2-inch rings compared with a 30-foot calico scallop trawl lined with 1-inch mesh. When towed on smooth bottom, the 30-foot trawl caught significantly more scallops than the dredge. On rougher bottom, the trawl became loaded with shells, rocks, and other debris. These made it more difficult to handle than the dredge, and required more culling of scallops from the debris brought on deck.



'Cobb's' Pot Gear Fishes Black Cod With Encouraging Results

The John N. Cobb returned to Seattle, Wash., on Oct. 18, 1968, after an 18-day black cod (*Anoplopoma fimbria*) gear research cruise in offshore waters of the North Washington coast and in the Strait of Juan de Fuca. (Gear Research Cruise No. 14; Cobb Cruise 98.)

The scientific staff reported: "Initial testing of potgear for fishing black cod provided encouraging results. Effectiveness of

pots opposed to longline gear was not fully evaluated due to low availability of fish and the presence of dogfish in each area."

In addition to the main objective of determining the feasibility of using trap-like gear (pots) for catching black cod, the staff aimed to: (1) determine the best size and depth of tunnel entrances for leading fish into the pot; (2) determine optimum soaking time; (3) determine whether cut bait in plastic screen bags would attract fish as opposed to open exposed bait; (4) and to determine suitable pot size for fishing and handling aboard fishing vessels.

Gear

The cruise began with 8 modified king crab pots (8' x 6' x 3') covered with 3-inch (stretched measure) webbing of 18-thread nylon. Each pot had 4 funnel-shaped openings extending inward about 10 inches and terminating at 6-inch rings. Ring size (tunnel) openings were increased to 8 inches in latter part of cruise. Pots were equipped with 140 fathoms of buoyline, buoys, and trailer buoys. Weight of each pot was 450 pounds. Near end of cruise 3 more pots, 4' x 4' x 3', were used to replace 4 of lost larger size pots.

Four skates of commercial black cod longline gear, 2 skates at one time, were used to determine availability of fish in an area, and as a standard gear to ascertain effectiveness of pots.

Bait

Commercially frozen bait herring was used in pots. The longline gear was generally baited with herring, although a small amount of octopus was used on several skates of gear.

Area of Operation

Two different areas off North Washington from 96 to 110 fathoms were selected as sites for experimental research. These areas had not been fished by black cod fishermen for several years but, at one time, were known to produce commercial quantities.

Method of Operation

Longline gear was usually baited with cut herring, but several times a bait-sized piece of octopus was put on every fourth hook. Pots

were baited with herring cut into small pieces and inserted into plastic screen bait bags. The bags were then folded over at top, strung onto heavy gauge-wire bait hooks, and hung 2 to a pot between openings.

The fishing areas were first tested with longline gear to see whether black cod were present. When evidence appeared, baited pots were set individually and spaced $\frac{1}{4}$ mile to $\frac{1}{2}$ mile apart in one row. Flagpoles and trailer buoys were set out at each end of set as a location aid when returning to lift the gear.

Weather

Except for first 2 days, cruise weather was poor. The Cobb was turned back 8 times due to heavy seas and high winds. Swells were 18 to 20 ft. and winds 38 to 43 knots.

Gear Losses

Four large pots were lost. Two were lost to a steamship that cut off buoy lines. Buoys were recovered later. One other pot was picked up by a trawler and later returned to Cobb; one pot remains lost. One and one-half skates of longline gear became fouled on the bottom and were lost.

RESULTS

Offshore Waters

Due to bad weather, low availability of black cod, and unscheduled surveillance assignments, the pots were lifted only 4 times. The longline gear was set and hauled 12 times, mostly in search of fish. The 2 areas fished off Northern Washington were:

Area 1 48°13' N. 124°57' W.
Area 2 48°13' N. to 48°22' N. 125°11' W.

Date	Haul	Area	No. of Pots Lifted	Water Depth	Black Cod Caught	Size (cm.)	Other Fish	Total
10/8	1	1	6	98-104F	28	45-61	2	30
10/10	2	1	4	98-104F	19	45-61	1	20
10/13	3	2	6 (4 lg.- 2 sm.)	96-110F	16	65-78	2	18
10/15	4	2	6 (4 lg.- 2 sm.)	96-110F	18	70-80	4	22

Between lifts 2 and 3, bait and tunnel openings to the large pots were modified. Openings on one pot were changed from 6 to 8 inches, which resulted in taking larger-sized

black cod. Triggers (escape prevention) were added to 3 pots, and one pot was not changed (control). Pots with 6-inch openings and triggers caught less fish than control pot without triggers.

When a pot was baited with exposed bait, the bait was completely gone when pot was lifted. Conversely, the bait in pots where bait was in plastic screen bags was practically untouched at lifting time. These pots could be reset without rebaiting.

Longline Gear

Two skates of longline gear were set and hauled 12 times in areas 1 and 2. Four sets were made before any evidence of black cod was found. Results of sampling with longline gear were:

Date	Area	Depth	Bait	Soaking Time	Black Cod	Dogfish	Other	Total
10/2	2	98-106F.	Herring	3 hrs.	0	43	0	43
10/2	2	98-100F.	"	2 "	0	42	0	42
10/3	2	101-110F.	"	2 "	0	4	3	7
10/3	1	100F.	"	2 "	5	22	0	27
10/7	1	101-105F.	Herr. & Octopus	2 "	0	35	1	36
10/10	1	98-101F.	"	1 1/2 "	0	27	0	27
10/12	2	98-104F.	Herring	1 " 10 min.	1	31	0	32
10/13	2	101-105F.	"	1 1/2 hrs.	0	39	0	39

Twice when octopus was used on every fourth hook, the octopus remained on hook after each hauling, but the herring was gone.

Total Catch Off Shore

Eighty-one black cod and 9 other incidental fish were taken in pots in offshore waters. Four lifts totaling 22 pot-sets were made. Sixteen longline sets produced 6 black cod and 253 dogfish. Less than 50 pounds of bait was used in the pots; the longline gear required 200 pounds.

Results in Strait of Juan de Fuca

On Oct. 15, 1968, operations were moved into the Strait of Juan de Fuca near Dungeness Spit, where both pots and longline gear were set in 70-78 fathoms. The longline gear was soaked 2 hours and caught 38 dogfish and 2 ratfish. The pots were hauled after soaking 6 hours and the catch was only one dogfish. The pots were taken aboard and reset in shallow water (15-20 fathoms). After soaking 15 hours, 3 dogfish and 1 large truecod were in the pots. Sandfleas had completely eaten the

dogfish. The baitbags were completely covered with sandfleas, but they did not penetrate the plastic screen bags.

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



'Jordan' Studies Sonar Targets to Distinguish Anchovy

The David Starr Jordan cruised California waters in October 1968 to evaluate sonar targets in order to distinguish anchovy from non-anchovy schools; investigate the replication (return or reperussion) of the number of sonar targets per unit area and as affected by time of day, light, and schooling intensity; and to investigate the effects of sonar pulse length, transmission power and frequency on replication of sonar targets. (Cruise 28; Sonar Evaluation #2.)

Methods and Procedures

Tactical trawling: Usually at 4:30 a.m., at first sign of school formation, one school was chosen for trawling and ship coned onto site school occupied.

Sample trawling: At noon and midnight, samples were taken from 200 meters to surface with the midwater trawl.

Sonar evaluation: Two 3 x 6 km. (2 x 4 mi.) grid areas were established, one 3 km. (2 mi.) northeast of Arrow Point, Catalina Island, and one 3 km. (2 mi.) southwest of Ribbon Rock, Catalina Island. These sites were picked because of the density of targets and because they could be alternated if an unfavorable sea state was encountered on one side. The transducers were trained 90° to the right with a 5° down angle. Near-ship targets could be checked for surface signs of such well-known false targets as wakes of small boats, kelp, and flotsam. An XBT was taken with each grid to get some idea of thermal structure and effect it might have on sonar target count.

Results and Conclusions

Tactical trawling was impossible on the surface schools which formed most of the targets. By the time trawl had been set to

depth, the approach of the ship either had caused school to split or veer to one side of ship. Although this behavior could be watched on the sonar PPI display, the ship could not turn on short notice at this low speed with the trawl out. Several pounds of anchovy were taken in each set, but there is no way of knowing whether these fish were part of target school or not. The scientists tried approaching the school with acoustic gear turned off--with essentially no effect. They maneuvered ship so school was on port beam, and approached it with a 270° right turn--with no effect.

In summary, the scientists report the trawl is a poor sampler of small schools of rapidly swimming organisms in the surface layer, even though some individuals are caught.

Sonar Evaluation

The Jordan occupied 36 successive grids for sonar mapping in a single place. Twelve additional grids were occupied at another time during the dark phase of the moon for comparison of night schooling. Each grid consisted of two 6 km. (4 mi.) long transects. Preliminary analyses indicate that the day-night target ratio is about 4 to 1 for the 30 kHz unit.

Possible explanations for the night decrease in number of sonar targets are: (a) some targets migrate down at night; (b) some targets are masked by planktonic volume reverberation when plankters migrate upward at night; (c) the organisms making up some targets change spacing at night so they no longer reflect underwater sound; (d) some combination of these.

In the first 75-hour run, there was an average of 19.6 targets per grid from 0400-0800, 109 targets per grid from 0800 to 1600, 25.4 targets per grid from 1600 to 2000, and 31.4 targets per grid from 2000 to 0400. Lowest concentrations were at dawn and dusk, as seen on the 30 kHz sonar. For this unit, area with the most targets was 18.5 km² or 5.4 square nautical miles. In all, there were 1,791 discrete targets. Further analysis will be necessary to describe similar relationships for the 11 kHz unit. Preliminary analysis of target size indicates a range of school size from 15 to 300 meters diameter. The mixed layer depth was 5 to 25 meters, with intense interval wave action through the entire survey.



'Oregon' Checks Florida's Scallop Grounds

BCF's exploratory fishing vessel Oregon returned to St. Simons Island, Georgia, on Oct. 25, 1968, after 18 days of scallop explorations off Florida's east coast. (Cruise 134, Oct. 8-25.) This was the ninth in a series of industrial development cruises to keep an up-to-date check on the Cape Kennedy calico scallop (*Pecten gibbus*) grounds.

The cruise purpose was to determine the best areas for commercial exploitation in the time available. Four standard transects were conducted in 10- to 40-fathom depths, as in all previous cruises in this series beginning in September 1967.

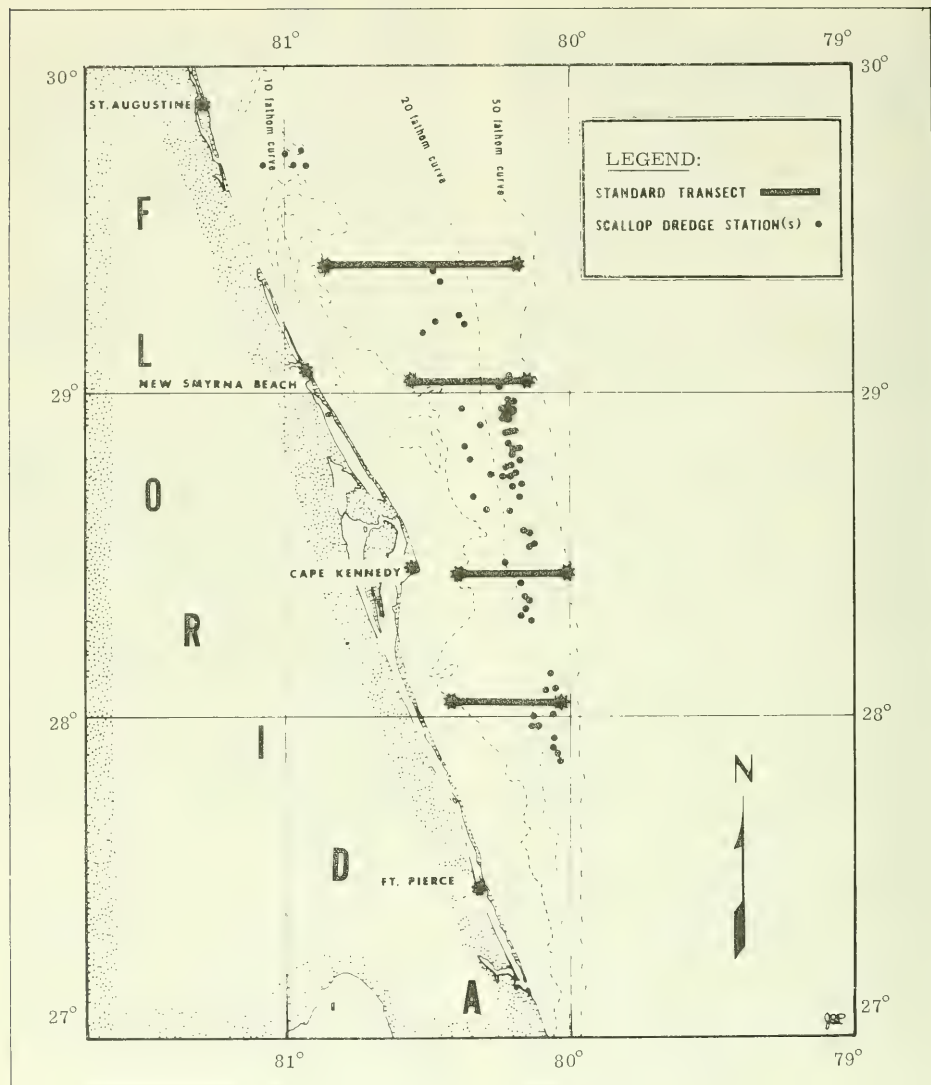
The Operation

116 dredging stations were occupied with an 8-foot tumbler dredge, finished with 2-inch diameter rings, 20 rings deep, from southeast of St. Augustine to northeast of Bethel Shoal. Commercial scallop concentrations were located in 26 fathoms east of Cape Kennedy. There, meat counts of 46 to 68 per pound surpassed previous counts for that area. East of New Smyrna, the maximum catch was 2.9 bushels per 30-minute drag. Meat counts ranged from 62 to 66 meats per pound in this area; however, the majority of scallops were subcommercial size (20 to 40 mm.). East of Cape Kennedy, maximum catches ranged from 5 to 8 bushels per 30-minute drag. Meat counts ranged from 46 to 68 per pound, and yielded 5 pounds per bushel. Northeast of Bethel Shoal, the maximum catch was 2 bushels per 30-minute drag. Meat counts ranged from 66 to 77 meats per pint.

Hurricane Curtails Cruise

The passing of Hurricane Gladys curtailed explorations for one week of this cruise. Therefore, only limited coverage could be devoted to some areas. Light coverage north of New Smyrna Beach and south of Melbourne may serve to explain partially the low catch rates there. However, a high incidence of starfish (*Asterias* sp.) east of Melbourne, along with numerous newly emptied scallop shells, could also be a factor affecting the area's catch rates.

Subcommercial size scallops (20 to 40 mm.) were numerous throughout the area, especially east of Cape Kennedy. There, one 30-minute drag in 22 fathoms yielded 32 bushels of seed scallops.



R/V Oregon Cruise 134, October 8-25, 1968.

'Delaware' Samples Sea Herring

The Delaware cruised the general area of Georges Bank and the continental shelf from Corsair to Hydrographer Canyon in fine weather from Oct. 9-18, 1968. (Cruise 68-10 & Part II of 68-9.) Her purposes were to: (1) sample populations of sea herring and obtain related environmental data, (2) make plankton tows for larval herring, (3) obtain hearts from designated herring samples, and hearts and blood from designated lobster samples, and (4) tag and release lobsters.

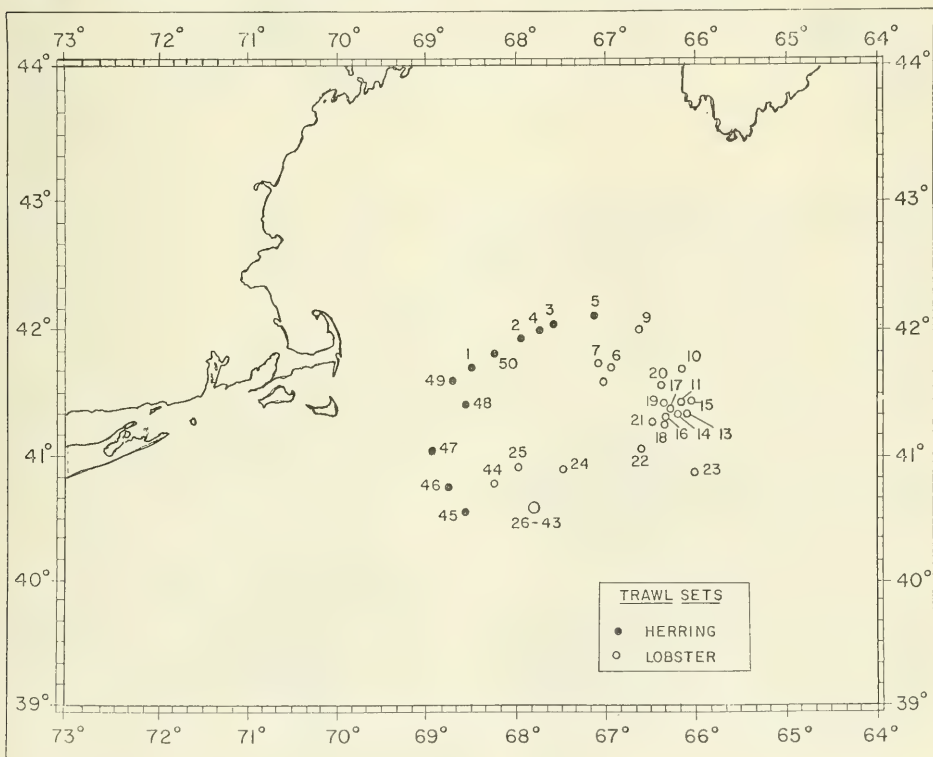
Herring

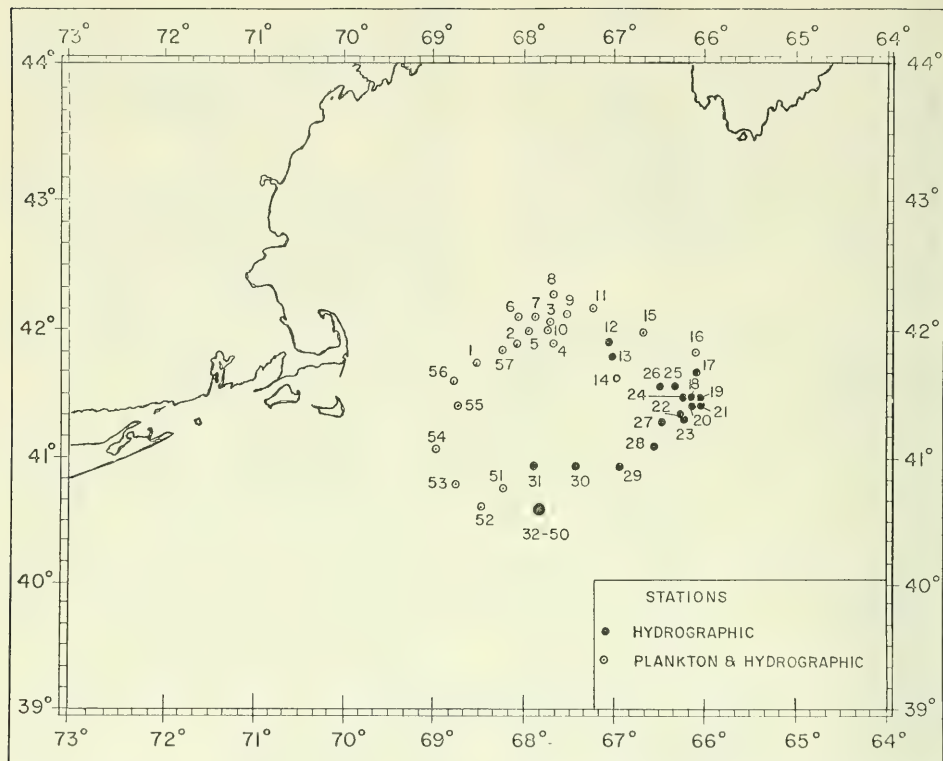
The staff made 14 trawl sets for herring in 30 to 86 fathoms at stations indicated on chart. The sets yielded about 2 bushels.

Herring were also caught (night and day) while trawling for lobsters in the shelf area; the yield was about $5\frac{1}{2}$ bushels. Shipboard examination showed the fish mostly spent. The range in length of the fish was 22 to 35.5 cm. with a mean of 30.6 cm.

Lobster

Thirty-six 1- and 2-hour trawl sets were made (see chart) for lobsters in 24 to 100 fathoms in general area of Corsair and Lydonia Canyons. Of 315 lobsters caught, 61.9% were females (37.7% of them berried). The carapace lengths ranged from 71 mm. to 199 mm. A total of 223 were tagged and released near Lydonia Canyon. Sixty-three lobster hearts were collected for racial studies. The remaining live specimens were returned to the laboratory.





Plankton Operations

Twenty-one 1-meter, 15-minute net tows (5 minutes at 20 meters, 10 meters, and at surface) were made during cruise (see chart). Larval herring obtained at 15 stations ranged from 6 mm. to 20 mm. with a mean of 11 mm.

Hydrographic Operations

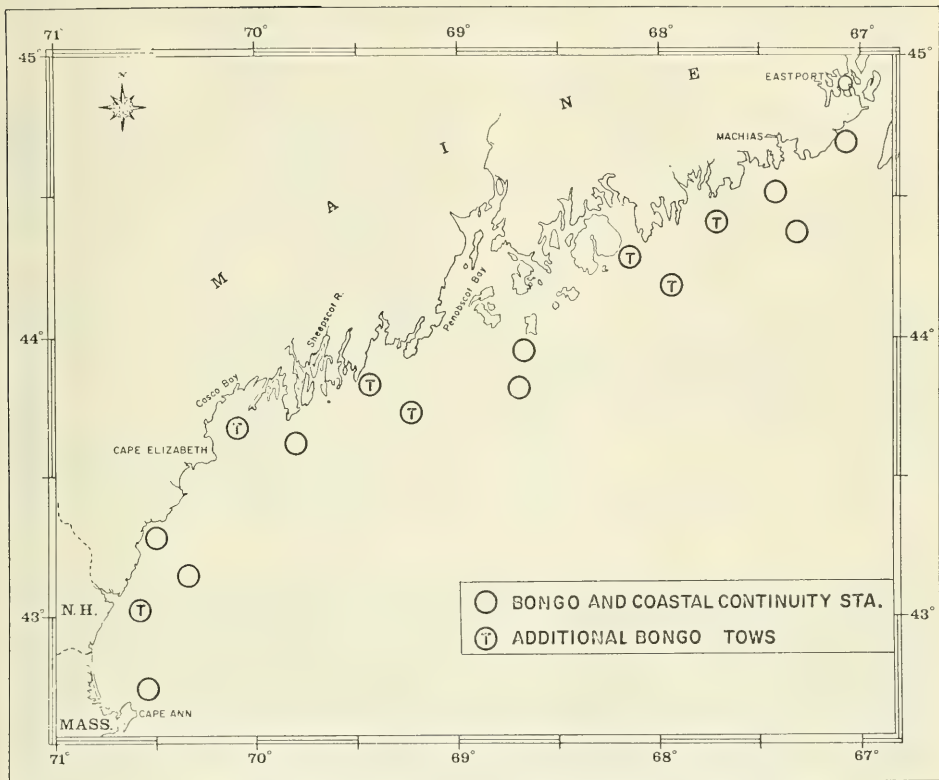
Fifty-seven BT casts were made, surface salinities collected, and related weather conditions recorded. The temperatures ranged from 13.6° C. (Sta. 31) to 20.9° C. (Sta. 50) at surface, and from 4.1° C. (Sta. 56 at 100 meters) to 15.1° C. (Sta. 4 at 40 meters and Sta. 53 at 75 meters) on the bottom. The

lowest temperature was 3.1° C. at station 6 at 75 meters (bottom was 7.0° C. at 225 meters). Surface salinities ranged from 32.273 ‰ at station #55 to 35.838 ‰ at station 50.



'Rorqual' Studies Zooplankton Distribution

The Rorqual cruised the waters off Cape Ann, Mass., to Eastport, Me., from Sept. 30-Oct. 10, 1968, to investigate the distribution of zooplankton and to monitor seasonal hydrographic conditions. (Cruise 8-68.)



R/V Rorqual Cruise 8-68, Sept. 30-Oct. 10, 1968.

A modified Brown-McGowan sampler (Bongo) was towed obliquely from the surface to 20 meters at 19 stations for 30 minutes.

Hydrographic Observations

A Nansen bottle cast was made to collect water samples for salinity determination at 0, 10, 20, 30 meters, and just above bottom. Bathythermographs traced vertical changes in temperature. Water transparency was measured at each hydrographic (continuity) station. Five surface drift bottles were released at 6 hydrographic stations.

Preliminary Findings

The volume of the zooplankton standing crop decreased from a summer mean of 5.31 cc/100m³ of water strained by the sampling

gear to 4.17 cc/100m³ during this cruise. The greatest decrease was in the eastern area. In previous autumns, the volumes decreased from west to east, but this autumn (as in past summer) the volumes in the western and central area were similar.

Larval herring were obtained in the central and eastern areas; they were most abundant in the eastern area. Large deposits of herring eggs were reported in September from the inshore vicinities of Cutler and West Quoddy Head. Special tows were taken there, but no large quantities of larvae were obtained. This is not unusual because the larvae are known to migrate or disperse after hatching.



'Miller Freeman' Proves Fine Research Ship

The new BCF research vessel Miller Freeman departed Seattle, Wash., in mid-February on cruise 68-02 (Feb. 12-Mar. 20, 1968). Primary objectives were to: monitor spawning of Pacific hake in California waters; determine the age, size, and sex composition of these hake stocks; and sample for changes in spawning habits of food and forage fish off the Washington coast.

Eggs and larvae were collected at stations along the standard Washington transect (fig. 2) at the beginning and end of the cruise, at 20 stations between San Francisco and Point Conception, Calif., and at 13 stations off southern California and northern Baja California. During the remainder of the cruise, the Miller Freeman conducted acoustic fish scouting and midwater trawling for adult hake.

In attempts to locate schools of hake off southern California, the Miller Freeman operated in company with the Exploratory

Fishing and Gear Research vessel "John N. Cobb" and the chartered vessel "Baron."

Sampling With Net & Trawl

Eggs and larvae were sampled with a 1-meter plankton net and adult hake with a $\frac{2}{3}$ -scale Universal trawl (with $1\frac{1}{4}$ -inch mesh and $\frac{1}{2}$ -inch cod end liner). The trawling system also included pelagic hydrofoil-type otter doors, electric conductor towing cables, depth telemetry, echo-sounder, winches, stern ramp, and hydraulic gantry.

Quantities of larvae of various species were taken off Washington, but eggs and larvae of hake were abundant only off southern California. Unfortunately, catches of adult hake were too small to permit analysis of the population features of the spawning stock.

The satisfactory performance of the newly commissioned Miller Freeman and its unique midwater stern trawling system were rewarding. The experience gained by the crew and laboratory scientists led to the correction of the observed shortcomings in the trawling equipment and procedures.



Fig. 1 - The Miller Freeman.

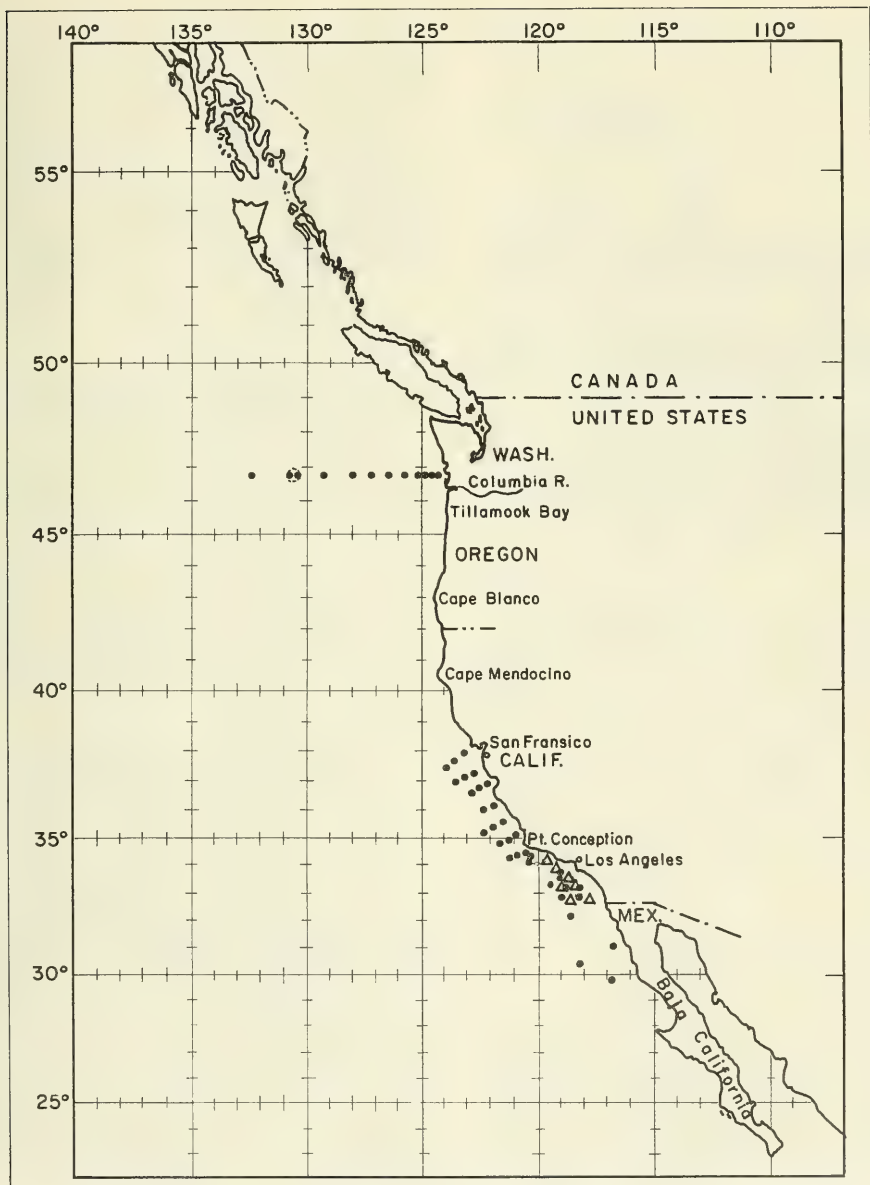


Fig. 2 - Egg and larval sampling stations (●), and trawling areas (Δ) of the Miller Freeman hake spawning Cruise 68-02.

The Miller Freeman promises to be an excellent ship from which to conduct ground-fish research.

--N. B. Parks, Fishery Biologist
BCF Biological Laboratory
Seattle, Washington



'Freeman' Studies Salmon Distribution & Environment Near Adak Island

The BCF research vessel Miller Freeman, Seattle (Wash.) Biological Laboratory, engaged in a fishery-oceanography cruise south of Adak Island in the central Aleutians, July 1-Aug. 15, 1968. Her objectives were to: (1) examine the distribution and relative abundance of immature sockeye and chum salmon in relation to environmental features, (2) compare indices of relative abundance of salmon from simultaneous catches by gill nets and purse seines, and (3) to study the effects of predation on gill-net catches.

The vessel fished gill nets along long. 176°22' W. from lat. 51°34' N. to 46°30' N., a distance of 320 miles. Sampling was concentrated north of 49° N.; it was apportioned among the various water masses and currents (figure 1).

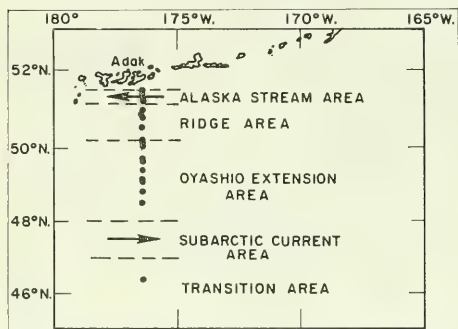


Fig. 1 - Fishing sites of the Miller Freeman and approximate location of surface currents and water masses south of Adak Island.

The basic net string consisted of 24 shackles (each 50 fathoms long--91.4 m.) of braided nylon nets--six each of $5\frac{1}{4}$ -, $3\frac{1}{4}$ -, $4\frac{1}{2}$ -, and $2\frac{1}{2}$ -inch mesh, stretched measure. A total of 39 sets yielded a catch of 3,413 salmon and steelhead trout.

Water mass and current boundaries were determined with an STD (salinity-temperature-depth) instrument. Temperature and salinity profiles to 1,500 meters were taken along the entire cruise track during early and mid-July; additional STD casts were made at each fishing station. A series of shallow casts was made across the axis of the Alaskan Stream in July and early August. Rapid identification of water masses and currents permitted changes in fishing sites to sample specific water masses of the Subarctic Pacific Region.

Temporal & Spatial Distribution & Salmon Abundance

Catches of salmon and steelhead trout varied both temporally and spatially. Their distribution and abundance in relation to environmental features were:

Sockeye salmon: Immature sockeye salmon accounted for 72% of total catch. Of these, 87% was age .1 (1 winter at sea); most of the rest were age .2 (2 winters at sea). The average catch per unit of effort (CPUE), giving equal weight to each mesh size was 8.3 for age .1, and 1.1 for older fish. Age .1 sockeye salmon were relatively more abundant in 1968 than in 1967. Although distributions of both age groups were similar, they fluctuated among the Alaskan Stream Area, the Ridge Area, and the Oyashio Extension Area (figure 2).

The center of abundance of immature sockeye salmon was primarily in the Ridge Area and Alaskan Stream, but shifted during different segments of the netting period. The areas of highest abundance of age .1 salmon were: early July--southern part of the Ridge Area; mid-July--northern part of the Ridge Area and the Alaskan Stream; late July--Alaskan Stream Area (although abundance was also high throughout the Ridge Area); early August--Ridge Area (nearly absent in the Alaskan Stream Area); and mid-August--Ridge Area and the Alaskan Stream Area. The distribution of the much less numerous age .2 sockeye salmon was similar to that of age .1 fish, except that in early August the age .2 immatures were most abundant in the southern part of the Ridge Area and in the Oyashio Extension Area. Thus, the abundance of immature sockeye salmon appeared to fluctuate primarily between the Alaskan Stream and Ridge Areas.

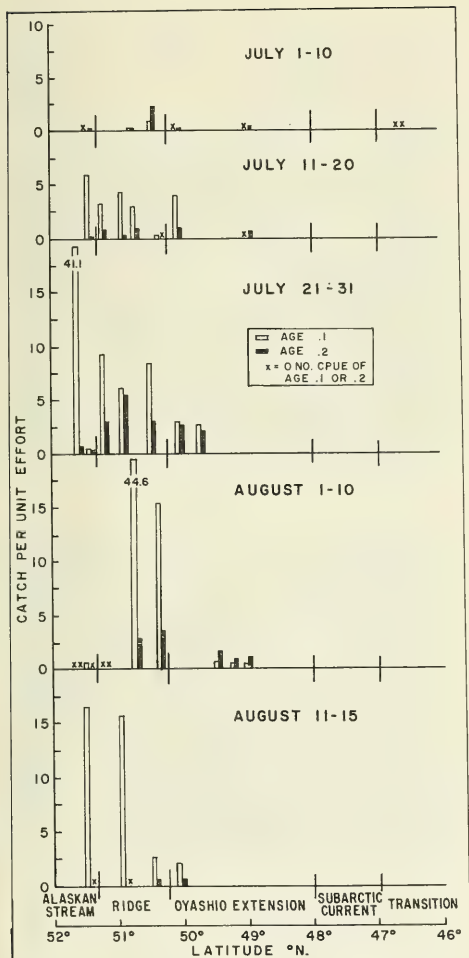


Fig. 2 - Relative abundance of immature sockeye salmon, summer 1968.

Chum salmon: Immature chum salmon accounted for 16% of the total catch. Nearly 60% was age .1 and the remainder age .2 or older. Abundance of immature chum salmon was relatively less than in 1967. The average CPUE in 1968 was only 1.1 for age .1, and 0.7 for age .2 immatures.

The distribution of immature chum salmon was roughly similar to that of sockeye salmon and, although it usually covered a wider area, differences in distribution between age groups were greater (figure 3). The distribution of age .1 fish was: (distribution of age .2 and older fish is given in parentheses when significantly different) early July--Oyashio Extension Area and southern part of the Ridge Area; mid-July--most abundant in the Alaskan Stream Area and scarce in the other water masses (age .2 fish were virtually absent from Alaskan Stream and scarce in Ridge Area and Oyashio Extension Area); late July--moderately abundant in Alaskan Stream Area, relatively scarce in Ridge Area, and absent in Oyashio Extension Area (age .2 fish were scarce in Alaskan Stream and most abundant in northern part of Oyashio Extension Area, near lat. $49^{\circ}30'N.$); early August--scarce in all areas (age .2 fish were still concentrated in Oyashio Extension Area); mid-August--abundant in Alaskan Stream Area and scarce in other areas.

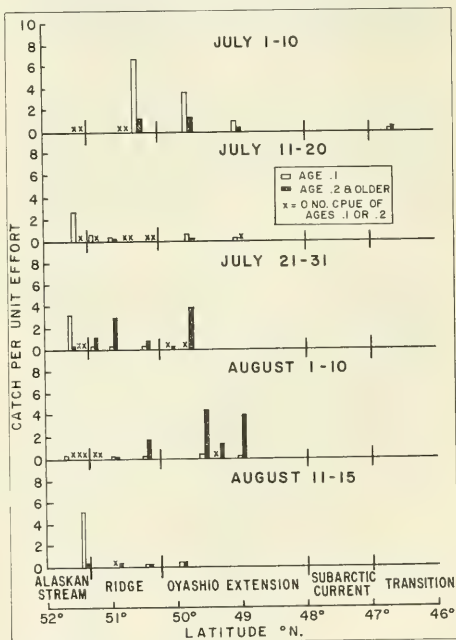


Fig. 3 - Relative abundance of immature chum salmon, summer 1968.

Immature chum salmon then, appeared to shift in abundance among Alaskan Stream, Ridge, and Oyashio Extension Areas.

Other species: Coho salmon made up about 10% of total catch; a few pink and chinook salmon and steelhead trout were also taken. Most salmon were caught in Ridge and Oyashio Extension Areas in late July and early August. Only 13 steelhead trout were captured, mostly from Oyashio Extension Area south of lat. 50° N.

Significance of Catches

The catches of immature sockeye and chum salmon suggested that abundance of the immature fish was not constant in any area--but changed as successive fluctuating waves passed from one water mass to another. These results also raise the possibility that these species may migrate from south to north before turning west in the Alaskan Stream and Ridge Areas.

Data are inadequate to infer migration patterns for coho, pink or chinook salmon, or for steelhead trout.

Vertical Distribution

A panel of deep nets was fished at one end of the net string, separated from the regular net string by a 15-fathom line. The panel consisted of a string of 4 surface nets of 5 $\frac{1}{4}$ -, 3 $\frac{1}{4}$ -, 4 $\frac{1}{2}$ -, and 2 $\frac{1}{2}$ -inch mesh, and 2 identical strings of nets attached in a series below surface string. The depth fished by the deep panel extended to about 23 meters as opposed to 7 meters of regular string.

Of 647 salmon and steelhead trout caught in the deep panels, about 62% was captured in the surface nets (0-7 m.), 23% in middle nets (7-15 m.), and 15% in bottom nets (15-23 m.), table. The percentage distribution of sockeye and chum salmon in the 3 depth strata were fairly similar, although chum salmon occurred less frequently in surface nets and more frequently in bottom net than did sockeye

salmon. The vertical distribution of coho salmon was similar to that of chum salmon; over 25% of catch was in bottom net. Catches of chinook and pink salmon and steelhead trout were small; chinook salmon were caught primarily in bottom net, whereas 4 of the 7 pink salmon, and 6 of the 7 steelhead trout, were caught in surface net.

Deep nets will be used in the future to examine further the vertical distribution of salmon in relation to water masses and currents.

Predation Studies

Although it is known that sea lions, fur seals, birds, and possibly sharks feed on salmon caught in gill nets, the effect of predation on catch rate has not been determined. To investigate this relation, dead salmon were attached to the gill net at time nets were set. The fish were tied to the cork and lead lines. Normally, 20 fish were attached per night and records kept of number of "decoy" fish recovered when nets were lifted.

The total loss of decoy fish was 67%; the high loss indicates predation could have an important effect on catch rate. Loss tended to decline as distance offshore increased. Inshore, where sea lions, seals, and birds were more numerous, loss of decoys often reached 100%. Beyond 100 miles, loss was still great, from 15 to 57%, and averaged nearly 40%.

The loss of decoy fish was not directly proportional to size of salmon catch. In 4 of the 5 sets in which total catch was less than five fish, 100% of decoy fish was lost; in 8 of the 9 sets in which catch exceeded 100 fish, an average of over 70% of the decoys was lost.

Comparative Fishing

The Miller Freeman made 10 gill-net sets in the immediate vicinity of purse-seine vessel 'Commander' (Fisheries Research Institute, University of Washington, Seattle)^{1/} to compare catch rates of the 2 types of gear.

Catch of Salmon and Steelhead Trout in Gill Nets, by Depth of Net, During Studies of Vertical Distribution in Spring 1968

Species	Total Number of Fish	Depth of Gill Net					
		0-7 m		7-15 m		15-23 m	
		Number of Fish	Percentage	Number of Fish	Percentage	Number of Fish	Percentage
Sockeye	444	290	65.3	111	25.0	43	9.7
Chum	105	53	50.5	26	24.8	26	24.7
Pink	7	4	57.1	1	14.3	2	28.6
Coho	73	43	58.9	11	15.1	19	26.0
Chinook	11	3	27.3	1	9.1	7	63.6
Steelhead	7	6	85.7	0	0.0	1	14.3
Total	647	399	61.7	150	23.1	98	15.2

^{1/}Under contract to BCF.

Because both types had been used to index salmon abundance in Adak Island Area, it was necessary to determine extent to which these different methods of sampling agreed in providing indices of salmon and trout populations.



Fig. 4 - Setting nets from the Miller Freeman.



Fig. 5 - Hauling gill nets aboard Miller Freeman.

Comparison of purse seine and gill-net catches in previous years indicated considerable discrepancies in catch. Indeed, it showed little correlation in abundance or species composition. Comparisons in 1968 also indicated similarities and inconsistencies previously observed. Large gill-net catches were correlated with large purse-seine catches; large purse seine catches, however, did not necessarily accompany large gill-net catches.



Fig. 6 - Taking STD from Miller Freeman.

Comparisons of these 2 types of gear were difficult because of inherent differences in gear and methods of fishing. (Factors that influence such comparisons are subject of a separate paper^{2/})

A Successful Cruise

The Miller Freeman's 1968 summer cruise successfully completed the major objectives. It obtained new information on distribution of salmon in relation to environmental features. This information was presented at the 15th Annual Meeting of the International North Pacific Fisheries Commission (Seattle, Wash.) in November 1968.

^{2/}Craddock, Donovan R. 1968. Comparisons of gill net and purse seine catches of salmon in North Pacific Ocean. Unpublished MS, Biological Laboratory, BCF, Seattle, Wash.

--By J. R. Dunn and D. F. Sutherland
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'Manning' Explores for Shrimp in Kodiak Island Area

BCF's John R. Manning returned to Juneau, Alaska, on Oct. 2, 1968, after a 13-week combination exploratory fishing and gear research survey for shrimp in the Kodiak Island area (Cruise 68-2).

The area included selected bays along the eastern and western shores of Kodiak Island, offshore waters along the eastern shore of

Kodiak Island, Shelikof Strait, and bays along the Alaska Peninsula between Cape Douglas and Wide Bay.

Cruise objectives were to (1) test-fish a BCF-developed 2-bag shrimp trawl on commercial fishing grounds to determine degree of separation of groundfish and debris from shrimp; (2) gain information on distribution and size of commercially interesting shrimp species: pink (*Pandalus borealis*), coonstripe (*P. hypsinotus*), humpy (*P. goniurus*), and sidestripe (*Pandalopsis dispar*); (3) make



Area of operations Cruise 68-2.

exploratory tows for shrimp in areas preselected by local Kodiak fishermen to determine if commercial size catches could be harvested; (4) conduct a preliminary bulk-shrimp pumping trial to see if shrimp could be pumped from a test tank, and (5) log sightings of foreign fishing vessels for Branch of Enforcement and Surveillance.

During survey, 102 drags were made. Trawls utilized were (1) an 85-foot Universal shrimp trawl--23 drags, (2) a 66-foot Kodiak shrimp trawl--59 drags, (3) a 70-foot two-bag shrimp trawl--16 drags, and (4) a 40-foot Gulf shrimp trawl--4 drags.

The largest catch occurred 35 miles east of Two Headed Island, during tow 69, over a bottom depth of 81 to 90 fathoms. There, 26,400 pounds of Alaska pollock (*Theragra chalcogrammus*) were collected in a haul of assorted groundfish totaling 28,800 pounds.

Exploratory Fishing

Shrimp explorations were conducted in inshore and offshore waters of Kodiak Island and Shelikof Straits (Fig. 1) using a standard commercial 66-foot shrimp trawl. Fifty-seven stations were fished throughout the survey area. Catches ranged from 0 to 13,500 pounds of shrimp per hour fished, and averaged 1,343 pounds per hour for all drags.

Pounds of Shrimp	No. of Drags
0 - 499	31
500 - 999	6
1,000 - 1,999	7
2,000 - 2,999	6
3,000 - 2,999	3
over 4,000	7

Drags that produced over 1,000 pounds per hour were made in Marmot Bay, Marmot Gully, 13 miles ESE Geese Island, Wide Bay, Raspberry Strait, south and north Arms Uganik Bay, Uganik Bay, and Uganik Passage, Kuliak Bay, Kinak Bay, 5 and 7 miles east of Kiukpalik Island, and Kukak Bay.

Universal Shrimp Trawl

Preliminary tests were made with an 85-foot universal shrimp trawl designed by BCF's Exploratory Fishing & Gear Research Base in Seattle, Wash. The universal trawl is designed to be fished either off-bottom at intermediate depths, or on bottom.

Initial trials were conducted in Viekoda Bay during daylight. During all dragging, a light off-bottom trace of shrimp was showing on echo sounder. Four drags were made with the trawl doors from 3-7 fathoms above bottom. In all cases, the trawl's footrope came into contact with bottom as shown by composition of catch. Four drags also were made at mid-depths: the trawl doors were 7-33 fathoms above bottom. The on-bottom catches of shrimp ranged from 301 to 2,160 pounds and averaged 1,173.5 pounds per hour fished; the mid-depth catches ranged from 85-858 pounds and averaged 430.7 pounds per hour fished.

One very noticeable difference between on-bottom and mid-depth catches was species composition. The former consisted of 67.12% pink, 26.27% humpy, 5.55% sidestripe, and 1.05% coon stripe shrimp; the mid-depth catches consisted of 80.78% humpy, 18.74% pink, and .48% sidestripe. No coon stripe shrimp were taken at mid-depths. The average catch per hour of humpy shrimp was about same for on-bottom (307.8 pounds per hour) and mid-depth drags (348 pounds per hour); pink and sidestripe shrimp increased in on-bottom drags. The on-bottom and mid-depth experiments with universal trawl were continued in Marmot Bay. Three 1-hour drags were made in Viekoda Bay procedure. The on-bottom drag produced 666 pounds of shrimp; the mid-depth trials (3-9 fathoms off-bottom) caught 200 pounds and (28-53 fathoms off-bottom) 33 pounds.

Two-Bag Trawl Tests

Sixteen test tows were made with the 2-bag trawl. Gear testing was conducted in areas routinely fished by commercial trawlers: Marmot Bay (1), Uganik Bay (4), Kiliuda Bay (4), Sitkalidak Strait (2), and off Dangerous Cape (2). Three more tows were made in Viekoda Bay on western side of Kodiak Island. Sampling depth varied between 32 and 85 fathoms in Viekoda Bay, and between 41 and 74 fathoms along eastern shore of Kodiak Island. Results from 15 test tows showed 83.33% (17,078 pounds) of shrimp collected in shrimp bag, while 16.66% (3,415.5 pounds) was collected in fish bag. The percentage composition of groundfish was 12.46% (1,276 pounds) in shrimp bag, and 87.53% (8,962.4 pounds) in fish bag.

Shrimp-Pumping Trials

A capsule pump like those in South American anchovetta fishery was used in shrimp-pumping trials aboard Manning. The submersible pump housing was lowered into a

test tank filled with seawater and shrimp. Results of trials were negative. The shrimp, unlike fish, did not flow toward and into pumping stream. A vertical mass of shrimp remained surrounding the housing after water had been pumped from test tank. An adapter designed to increase the pump's effective drawing range will be installed during planned tests aboard a commercial trawler in the future.



BCF Scientist Aids Coast Guard's Glacier Study

Roger Theroux of the Woods Hole Biological Laboratory took part in a Coast Guard survey in summer 1968 of west Greenland waters aboard the USCGS "Eastwind". The survey was the first in a series of annual expeditions by the International Ice Patrol.

The project's objectives are "to determine the number of icebergs calved from the glaciers, and to survey the glacier fronts and environmental conditions affecting discharge, including the hydrography, bottom sediments and benthic organisms."

Theroux collected and studied benthic animals and helped collect bottom sediments.

The Operation

The field party joined the Eastwind at Thule, Greenland, and moved south along coast to Sondre Strømfjord. "Samples and observations for hydrographic and benthic studies were collected most frequently in fjords servicing berg-producing glaciers." Personnel went by helicopter to survey and mark glaciers.



Fast-Sinking Purse Seine Is Shaping Up

The July 1968 Commercial Fisheries Review reported the development of a fast-sinking purse seine that will provide tuna fishermen with more efficient gear.

In designing the "hybrid" net, M. Ben-Yami, visiting investigator from the Israel Department of Fisheries, worked with Roger Green, Fishery Biologist at BCF's Fishery-Oceanography Center at La Jolla, Calif. They attempted to combine "the fast-sinking qualities of the North Atlantic purse seine with the strength, deep-fishing, and ease of handling of the California tuna seine." Model tests of this net were very encouraging. So a full-scale net, 460 fathoms by 55 fathoms, was built in spring 1968 in a San Pedro net yard. It was field tested successfully with the help of Jerry Jurkovich, gear technician from the BCF Exploratory Fishing and Gear Research Base in Seattle, Wash.

Sea Trials

The initial sea trials showed that the new net sank about 70% deeper and at a significantly faster rate than conventional 7-strip tuna purse seines. The hybrid purse seine also maintained its initial diameter well into pursing. This was in contrast to conventional nets, whose tightly hung webbing during sinking causes the floats to bunch and the net's diameter to shrink; this results in crowding fish by a diminishing circle of webbing before escape routes are closed. "The deep, square cut ends (gavels) of the net, with their long, separately pursing, breast lines, showed no tendency to foul or roll in the purse line and were handled without loss of time. Also, because the gavels hang nearly vertically beneath the boat, the new net offered a very reduced escape route for fish."

A Minor Problem

Only one minor problem has been encountered: the net is somewhat more difficult to stack and takes longer than others. But with practice and modified handling techniques, this time may be shortened. The researchers expect that sinking rates and depths will increase as the net is "broken in" during fishing by removal of excess tar and increasing flexibility.



The famed explorer and oceanographer tells of the sea's riches and his approaching *Odyssey* aboard the 'Ben Franklin.'

THE PROMISE OF THE UNDERWATER WORLD

By Jacques Piccard

The underwater world holds promise and importance for all of mankind. In my estimation, it is as vital to the Australian sheep rancher or European housewife as it is to the Gloucester fisherman or Louisiana wildcatter. The sea affects all our lives in a variety of ways, and better understanding of the seas and their mechanics can only make the lot of all mankind easier, more productive, and more satisfying.

The theme of my remarks, then, is to be the need, by whatever means you gentlemen of the Congress ultimately decide upon, for speeding the orderly exploitation and development of the riches of the Continental Shelf and the oceans, which, rather than separating the United States from its Asian, European, or African neighbors, rather provides a ready and convenient link with them.

The vastness of the subject almost makes it impossible to know where to begin. Allow me to start with some of the more familiar uses and products of the oceans and proceed to some of the more exotic, esoteric fields where today we are just piercing the surface, so to speak.

For as long as man has lived on the shores of the oceans, rivers and lakes, he has been nourished by the fish he has been able to lure, trap, snare, spear, or net from the beach or a boat. It is amazing to note that the methods of catching fish are practically the same today as they were in the earliest dawn of mankind, and certainly not much more sophisticated than those in the days 2,000 years ago when men drew their precious food from the Sea of Galilee in straining nets and bobbing boats.

The processing and marketing of seafood have developed along technological lines, but

This article is nearly all of Dr. Piccard's testimony before a subcommittee of the House Committee on the Judiciary, July 24, 1968.

we are still in the Dark Ages when considering the search for fish, knowledge of their habits, spawning grounds and their nutritional value. Recent developments have been made in the production of fish protein concentrate, thanks to great encouragement and financial support by the U.S. Government, and a great deal more must be done to produce and merchandise this dietary supplement for Americans and, perhaps more importantly, for those millions of undernourished people whose protein supply is inadequate.

Better organized fishing methods will not only increase the catches and yields of the commercial fisherman, but will also help guard against the annihilation and disappearance of certain species of food fish--a sad fact which has already seen the reduction to dangerous limits in some areas of halibut, salmon, lobster, and shrimp.

Finally, it should be mentioned that while every maritime nation of the world has shown substantial increases in fish production and consumption, the United States has been at a virtual standstill, with fish imports rising to the point where Americans now eat more imported fish than that caught and processed domestically. Surely this is an area which deserves more attention and support.

Linked to the food-from-the-sea activity is the problem of pollution of the sea. This is a thorny problem, but because it is man-made, it admits of a solution. We have already seen great quantities of shellfish from large areas declared unfit for human consumption because of polluted waters--in the Raritan Bay area of New Jersey, for example.

We must guard against increasing destruction of the species and upsetment of the marine environment too by dumping, radioactive

waste discharging, drainage from industrial plants and even the introduction of the heated water used for cooling powerplants to normally cool fish feeding grounds. A problem such as this which transcends State borders seems to call for the attention of, if not the regulation by the Federal Government.

My father once said that exploration is the sport of the scientist, and it is in exploration that much of oceanographic activity is found today.

Gentlemen, we are standing not at a single threshold, but before a long corridor marked by a series of doors. Behind each is a new and exciting field of opportunity awaiting the imaginative, the daring, the enterprising men who are blessed with both vision and the means to exploit these riches.

Besides food, the oceans contain, or more precisely, separate man from rich mineral deposits. One authority has calculated that the seas contain 30,000 trillion tons of chlorine--that is 30 followed by 15 zeros--2,000 trillion tons of magnesium, and similarly staggering quantities of sodium, sulphur, potassium, bromide, and carbon, and so on. The interesting point is that these minerals are not found only in minute quantities in the water itself. Off the California coast, phosphorous nodules resembling large pebbles are scattered around the seafloor at depths from 200 to 8,000 feet at least. Best known are the manganese deposits, confirmed to exist in the Atlantic, Pacific, and Indian Oceans.

While sufficient quantities of these various elements are obtainable on land, their exploitation from the seabed will receive low priority. When poorer strata are mined on land, raising production costs there, greater attention can be expected for offshore mining development. Such was the case in the petroleum industry, which is by far the leading developer of offshore resources.

Today some 70 countries are involved in the quest for oil and gas beneath the Continental Shelf. Twenty countries are producing these products, by recent estimate.

Like every general statistic about the seas the figures regarding petroleum production and reserves defy the imagination. About one-fifth of the world's total known oil reserves of 425 billion barrels is found off-

shore. Currently about $5\frac{1}{2}$ million barrels are produced each day from wells sunk offshore. This is about 16 percent of the world total. In another 10 years perhaps 33 percent will come from offshore--all this to meet a demand which is increasing at a rate of 7 percent a year. No need to belabor the importance of offshore oil and gas production. It is, after all, the very *raison d'etre* of the legislation you are considering.

We must also acknowledge, too, that the water-starved areas of the globe see in the salty surface of the oceans, their first source of potable water, as desalination techniques grow and hold out promise of abundant fresh water everywhere in the world. If we could theoretically separate all the minerals from all the water in the oceans, we would have, on one hand, enough salts to fill a freight train stretching back and forth between the earth and the sun 300,000 times and, on the other, about 1,500,000 trillion tons of fresh water. I apologize for having to resort to these big numbers, but I know you gentlemen want to know the facts.

We are only beginning to fully appreciate the preeminent role of the oceans in the origin and influence of weather. If man is to accurately predict the weather, to guard against destructive waves, prepare for hurricanes and typhoons, and some day exercise a degree of control over the elements, he must learn a great deal more of the dynamics that go on where sea meets sky, and the massive movements of ocean waters from one region to another.

While these remarks have dealt with, let us say, peaceful or materially productive uses of the seas, we cannot overlook the strategic importance of the undersea world in defensive and possibly offensive warfare. Greater knowledge of the terrain, not only along the Continental Shelves, but in mid-ocean as well, is needed to assure the safe transit of military submarines. And we must understand the acoustic phenomenon better if effective defense measures are to be prepared.

The very immensity of the seas, which, as you know, cover about 70 percent of the earth's surface, makes a concise and specific summary of ocean-related activities difficult, if not impossible. Likewise, the fledgling efforts of governments and private industry are as diverse as the problems and challenges themselves.

Many, many American industrial firms have been attracted beyond the water's edge, so to speak. And they have invested sizable sums of their own money in the oceanography market. I would like to take just a minute to describe one of these programs, the oceanographic activities in which I am presently engaged with the Grumman Aircraft Engineering Corp. in Bethpage, N.Y.

Already a leader in the design and construction of military and private aircraft and sophisticated space vehicles, Grumman in 1965 appraised the oceanographic field and, rightly, I believe, saw there great potential.

In order to contribute to solving these problems of offshore mining, fish study, national defense, and the study of basic physical phenomena, it was decided to turn the vast engineering talent of the company to the development of a submersible vehicle, a work submarine which could bring man into the undersea environment to observe and perform useful tasks there.

About this time I became an exclusive consultant to Grumman, and after several studies, it was decided to build a mesoscaph or middle-depth submarine (from the Greek words for "middle"-"meso" and "ship"-"scaph"). It was to be based on a design I had prepared for an earlier submarine, the first mesoscaph, the "Auguste Piccard," named for my father.

Subsequently, the PX-15, as the Grumman submersible was called, was built in Switzerland at the same factory which constructed the first vessel. In about 1 year the PX-15 was practically fully completed. In early March it was partially disassembled--to allow it to pass by railroad through our Swiss tunnels to Antwerp, where it was loaded on a merchant ship and transported to the Grumman facility in West Palm Beach, Fla.

Grumman engineers and several of my staff have been engaged since April in the final outfitting of this unique research submarine. The vehicle is built of high-strength steel and is about 50 feet long and about 130 tons in weight, making it the largest research submarine in the world. It can dive to 4,500 feet before collapsing, but we shall limit its operation to 2,000 feet. The live support system can sustain six men for 6 weeks, giving us a great deal more submerged endurance than any other research vehicle.

And 29 portholes, a closed-circuit television system as well as fixed external cameras and recording devices assure that we can observe and document the underwater secrets we uncover.

The various unique features of the Grumman-Piccard PX-15 admirably suit it for our first major undertaking, a kind of undersea adventure, with "science nonfiction" objectives.

Early next year the submarine with six men, including myself, on board will submerge off the Florida coast and drift in mid-water at depths of 300 to 2,000 feet, propelled northward for 4 to 6 weeks only by the current of the Gulf Stream.

The scientists will conduct a series of long- and short-duration experiments concerning the mysterious Deep Scattering Layer, which "tricks" navigators by sending back false echoes on their fathometers and has implications in fish-feeding and marine-life cycles, on bottom topography, acoustics, marine biology, and fish habits, as well as analysis of the water's chemical properties, temperature, and speed.

The program is to be a cooperative enterprise with the U.S. Naval Oceanographic Office providing the all-important surface support ship (to give us navigational information) and two of the scientific observers on board the submarine.

When the Gulf Stream Drift Mission is terminated, probably 1,000 miles later off the coast of Massachusetts, the people at Grumman will make the submersible available on a lease basis to those who can best utilize its special depth, endurance, and large payload capabilities.

Just 2 weeks ago here in Washington, at a convention, we announced that the PX-15 henceforth will be known as the Ben Franklin, honoring your early American scientist-statesman, the man who first recognized the practical advantages of knowing and defining the limits of the Gulf Stream.

Franklin, as head of the U.S. Post Office, learned that British mail packets sailing from England, took 2 or 3 weeks longer to cross the Atlantic than Nantucket whalers returning from Europe. A conversation with some of the Yankee skippers brought the fact that they

avoided the Gulf Stream while the English "bucked" the current much of the way.

Franklin then asked several of the New England whalers to make temperature readings throughout the North Atlantic and from these reports he charted the first map of the Gulf Stream. He turned it over to the British General Post Office, and we can assume that a substantial decrease in the London-to-Philadelphia mailing time followed shortly.

Just this week at the West Palm Beach facility we will begin dockside tests of the Ben Franklin, and on August 21 we will hold the formal christening ceremonies.

This Grumman program will involve more than \$4 million of company funds, and it is just one of many pioneering efforts, some supported wholly or in part by Federal money, others purely company sponsored.

The important point, however, is that basic research into the workings of the world beneath the waves is moving forward. The Naval Oceanographic Office and the Office of Naval Research are spearheading this assault on the unknown, and scientists the world over acknowledge the preeminent position these agencies along with ESSA, the Bureau of Commercial Fisheries, and others occupy in the advancement of man's understanding of the oceans.



DO YOU KNOW?

Fish have "nurseries." These are the estuaries, which are among the world's most productive areas and include the bays, sounds, and nearshore areas that surround our coasts.

It is to these nutrient-rich waters that the "baby" salmon, shad, pompano, shrimp, and other important food fishes come to feed and grow until they have passed their "adolescent" stages and are ready to move into deeper water as adults.

Estuaries provide essential living space for more than 70 kinds of fish and shellfish that contribute 3 billion pounds, or two-thirds, of the total U. S. commercial fishing catch. Seven of the ten species most in demand, including shrimp, our most valuable fishery, and menhaden, our largest fishery, must have suitable estuarine nurseries.

Pollution of estuarine areas by chemical and human wastes, pesticides, and dredging and filling reduces important nursery areas. The result is a decrease in the commercial catch and less food for our growing population.

The estuaries are the "fishbasket" of our nation. It is vital that the best possible use be made of them for the benefit of all. BCF works with other government agencies to foster multiple use of these estuaries--but still protect those valuable natural resources.

--Catherine Criscione

U.S. AND JAPAN CONDUCT SUCCESSFUL SALMON RESEARCH CRUISE

By Robert R. French and Richard Bakkala

In a Commercial Fisheries Review article, May 1968, BCF's Seattle (Wash.), Biological Laboratory announced plans for cooperative research by the U.S. and Japan to study the distribution of salmon on the high seas. The two nations and Canada, as treaty members of the International North Pacific Fisheries Commission (INPFC), conduct research on fishery resources of common interest for effective utilization and conservation.

In the INPFC treaty of 1953, Japan agreed to abstain from salmon fishing on the high seas east of long. 175° W. Since then, however, we have found that sockeye salmon from Bristol Bay migrate westward past the abstinence line in varying proportions.

One objective of the cruise was to investigate the possibility of forecasting the percentage of the run available to the Japanese fishery each year. We also wished to test the hypothesis that the distribution and migration of sockeye salmon from Bristol Bay are related to specific water masses in the North Pacific Ocean.

This report gives preliminary data on the catches, and the location of these catches in relation to water masses, in April, May, and June. We also report results of predation studies by the BCF vessel.

Vessels and Fishing Gear

The participating vessels were the Seattle Biological Laboratory's R/V "George B. Kelez" (550 tons) and the Japanese research vessels "Wakashio-Maru" (150 tons) and "Hokko-Maru" (220 tons), all shown in figure 1. The three vessels fished with gill nets of various mesh sizes; the Japanese also used longlines for capturing salmon to be tagged. The tagging data are not reported here. The U.S. vessel fished a basic net string of 32 shackles (1.8 miles or 2.9 km. long) with five mesh sizes ($2\frac{1}{2}$, $3\frac{1}{4}$, $3\frac{7}{8}$, $4\frac{1}{2}$, and $5\frac{1}{4}$ inches--63, 83, 98, 115, and 113 mm.), stretched

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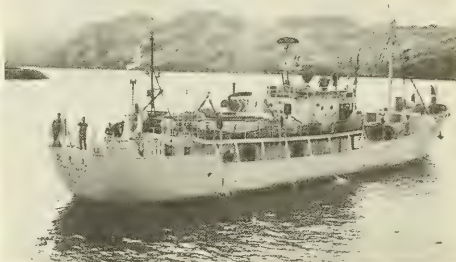


Fig. 1 - Cooperating research vessels--George B. Kelez (U.S.), Hokko-Maru and Wakashio-Maru (Japan).

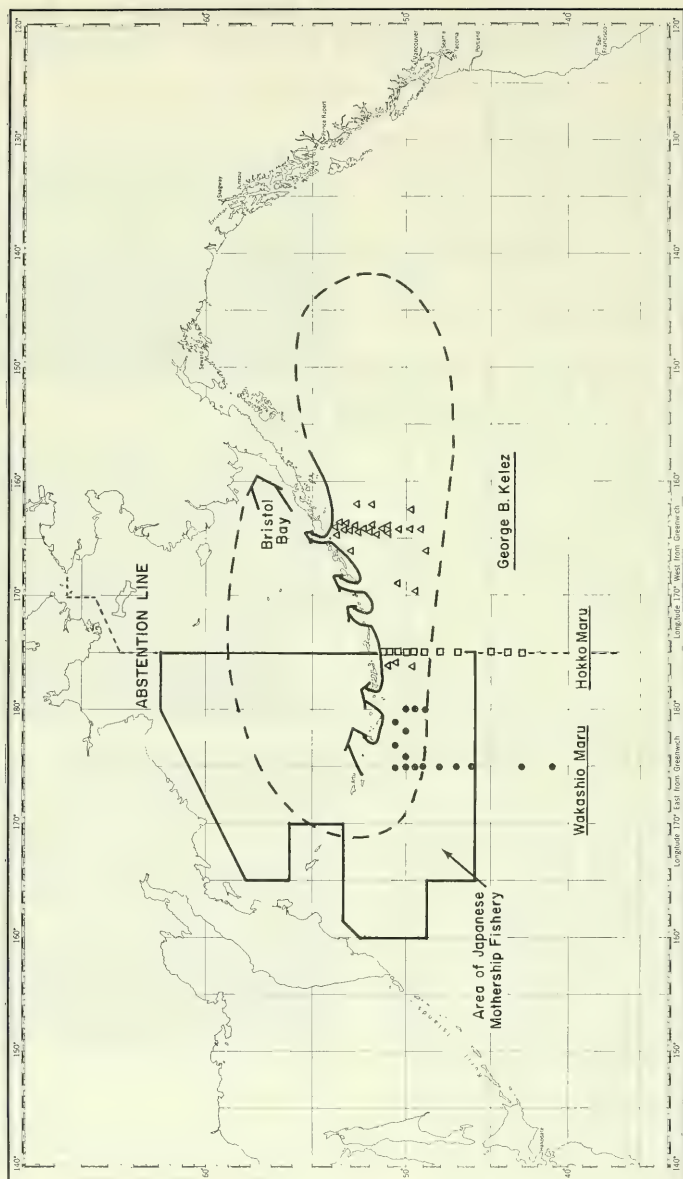


Fig. 2 - Stations fished by U.S. and Japanese research vessels and limits of distribution and migration routes for Bristol Bay sockeye salmon in relation to the mothership fishing area and abstinence line.

measure. The Japanese vessels fished a basic string of 50 tans (2.5 km.) and 75 tans (3.75 km.), consisting of five mesh sizes (2.1, 2.8, 3.6, 4.8, and 6.1 inches--55, 72, 93, 121, and 157 mm.).

Communications

The language difference prevented voice communication, but vessel activity was coordinated by use of the International Code. This method of communication proved satisfactory; it allowed daily radio schedules in which data were exchanged on vessel position, catch by species, number of gill nets fished, and water temperatures at various depths. The Kelez also communicated daily with the Seattle Laboratory via single side band radio. It sent catch results and oceanographic data; in return, the vessel received the positions of the various water masses to guide scientists in planning fishing stations.

Fishing Results

Fishing stations of the three vessels in relation to migration routes of maturing Bristol Bay sockeye salmon--and the area of the Japanese mothership fishery--are shown in figure 2. The Kelez fished in April, May, and June, primarily south of the eastern Aleutian Islands; the two Japanese vessels fished in May south of the central and western Aleutian Islands.

Sockeye salmon were widely distributed in April and May. The maturing and immature fish showed differences in distribution (fig. 3). Maturing sockeye salmon (to spawn in 1968) were in the Ridge, Oyashio Extension, and Subarctic Current Areas of the Subarctic Region, but not in the Transition Area. The one set in the Alaskan Stream also took no maturing fish. Immature fish (those that will remain at sea at least 1 more year) were primarily in the southern water masses--the Oyashio Extension, Subarctic Current, and Transition Areas--but were not taken south of lat. 46° N. By early June, maturing fish were relatively abundant in the northern part of the sampling areas in the western Gulf of Alaska (fig. 4). These salmon were en route to Bristol Bay; the main group migrated through this area from June 1 to 10. By the middle of June, the relative abundance of maturing sockeye salmon had decreased, and immature fish had appeared throughout the Ridge Area.

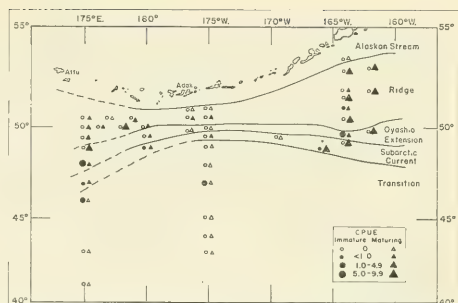


Fig. 3 - Relative abundance of immature and maturing sockeye salmon in April and May and location of water masses in the Subarctic Region of the North Pacific Ocean.

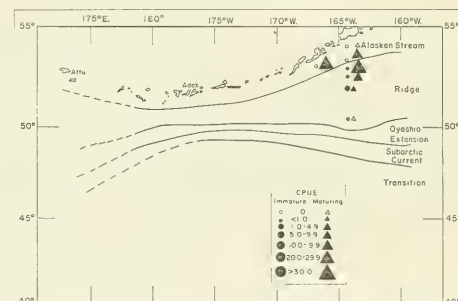


Fig. 4 - Relative abundance of immature and maturing sockeye salmon in June and location of water masses in the Subarctic Region of the North Pacific Ocean.

Of major significance was the indication that relatively few Bristol Bay fish were available to the Japanese high-seas fishery this spring. In the past, maturing Bristol Bay sockeye salmon were observed migrating westward from the Gulf of Alaska, thence northward through the eastern and western Aleutian passes. This route took part of the run past the provisional abstinence line at long. 175° W., where the fish were vulnerable to the Japanese mothership fishery. The proportion of the Bristol Bay sockeye salmon available to the mothership fishery varies from year to year for reasons not yet understood.

Evidently no major migration of maturing Bristol Bay fish passed the abstinence line in 1968. This was indicated by: (1) the low abundance of sockeye salmon along long. 175° W., which shows that Bristol Bay fish

had not reached this area by late May, and (2) the appearance in early June of migrating Bristol Bay fish in the western Gulf of Alaska--too far east to allow them to migrate westward past the abstention line and still reach Bristol Bay in the normal time period (early July). Subsequently, we found that exploitation of Bristol Bay sockeye salmon by the Japanese fleet was below average in 1968. Migrations of salmon may vary with the flow of the Alaskan Stream; this possibility will be investigated in future studies.

Chum salmon (fig. 5) were widely distributed in more southern waters on the two western cruise tracks, but they were farther north in the areas fished by the Kelez at the eastern stations. Past studies have shown that Asian stocks of chum salmon dominate in the central North Pacific Ocean--undoubtedly most chum salmon west of long. 175° W. were of Asian origin. The considerable abundance of chum salmon (not illustrated) in the Alaskan Stream and northern part of the Ridge Area in June indicates a northerly movement from waters occupied in May; the fish had migrated in the same time period and area as the sockeye salmon.

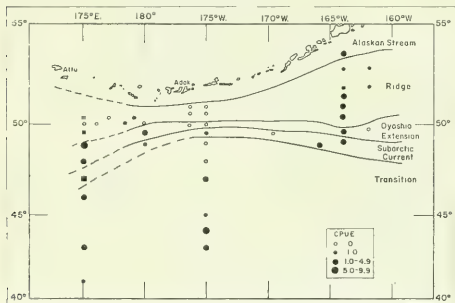


Fig. 5 - Relative abundance of chum salmon in April and May and location of water masses in the Subarctic Region of the North Pacific Ocean.

The distribution of pink salmon was similar to that of chum salmon (fig. 6). In the western part of the sampling area, they appeared in the southern water masses and were not generally abundant in the Ridge Area. In the eastern section, in May, they were most abundant in the southern part of the Ridge and Oyashio Extension Areas. By June, they were abundant in the northern part of the Ridge Area and Alaskan Stream (not illustrated).

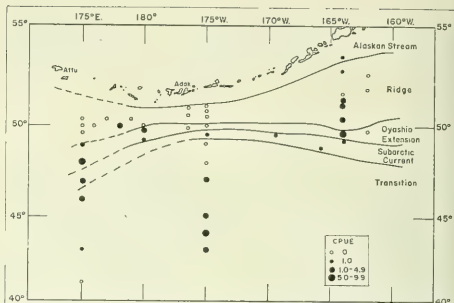


Fig. 6 - Relative abundance of pink salmon in April and May and location of water masses in the Subarctic Region of the North Pacific Ocean.

Predation

The George B. Kelez also conducted experiments on predation of salmon caught in gill nets. It has long been known that sea lions, fur seals, birds, and sharks feed on salmon in gill nets. The effect of the predation on catch rate, however, has not been determined. The method used was to attach freshly frozen salmon from the previous night's catch to the gill nets at time of setting; the numbers remaining were tallied when nets were hauled in the morning.

Total losses of "decoy" salmon amounted to about 29%. Loss was about 35% for fish attached to the corkline, and 21% for fish on the leadline (about 25 ft. or 7.6 m. below the surface). The greatest losses were at stations where we saw sea lions around the nets.

Losses of decoy fish decreased as distance from shore increased (fig. 7). Beyond 100 miles from shore, the loss was less than 20%, and in two of four sets no decoy fish were lost. Within 100 miles of shore, loss of decoys ranged from 22 to 90%.

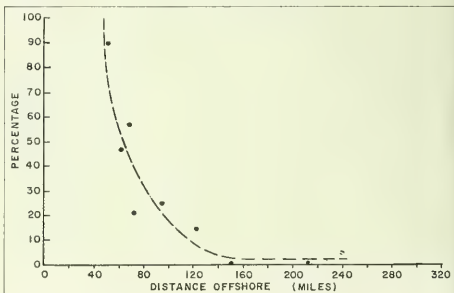


Fig. 7 - Loss of decoy salmon in relation to distance offshore (line fitted by inspection).

That salmon in gill nets are lost to predators is beyond question, but it is also necessary to evaluate the effect on catch rates in gill nets. A problem in present techniques is that live salmon may be taken by predators at any time during the night, whereas decoy fish are exposed to predators throughout the time the nets are in the water.

Effectiveness of Cooperative Cruise

This first cooperative cruise by researchers of the U.S. and Japan was successful. Despite language problems, effective communication between vessels was achieved. The results clearly demonstrate how much more

rapidly we can accumulate knowledge about the distribution and migration of salmon in offshore waters by coordinated operations of several vessels fishing simultaneously. The U.S. and Japan soon will prepare a joint report of the findings for the INPFC. We expect this type of cooperative research to continue.

Acknowledgments

We thank the Fisheries Agency of Japan for use of the Japanese catch data--in particular, scientists M. Osako and J. Ito aboard the Hokko-Marun, and M. Katsugi and G. Hoshiai aboard the Wakashio-Marun.



WHAT IS THE MOST IMPORTANT DISCOVERY MADE ABOUT THE OCEANS?

One of the most important discoveries about the oceans is the true nature of the sea floor. Not so long ago it was generally believed that much of the deep ocean floor was a featureless plain. We now know that there are numerous mountains under the sea, some of them higher than Mt. Everest. But perhaps the most striking discovery is that all oceans except the North Pacific are divided in the center by an almost continuous system of mountains.

Some of the other important discoveries are:

Discovery in 1938 of the coelacanth, a fish thought to have become extinct 50 to 70 million years ago, but which was found to be thriving off South Africa.

Discovery of a layer of living organisms spread over much of the oceans at a depth of several hundred fathoms (deep scattering layer).

Discovery of nodules of manganese, cobalt, iron, and nickel which can be dredged from the sea floor.

Discovery that the earth's crust is much thinner under the sea than under the land and that the bed of the ocean is underlain by basalt rather than by granite which makes up the continents.

Discovery of a deep sound channel that carries sounds for thousands of miles.

Discovery of life in the deepest parts of the oceans.

Perhaps the most important recent discovery is that man can live and work in the ocean for extended periods of time. Captain George F. Bond, a medical officer in the United States Navy, discovered that, once a diver's blood has become saturated with breathing gases at a given depth, decompression time is related only to the depth and not to the length of time the diver remains there. This led to the concept of underwater habitation by Cousteau and Link. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

For commercial fishermen, it is efficient means to take buffalo. For States seeking commercial gear to replace gill net, it is at least a partial solution.

A FLOATING TRAP NET FOR USE IN RESERVOIRS

By Gary Ackerman and Marvin F. Boussu

The trap net described here was designed and built by the senior author for a commercial fisherman who furnished the materials and helped to construct it. Essentially, the gear is a small trap net that uses a hoop net for the pot or crib section. The 200-foot-

long lead and the two 40-foot-long wings are 18 feet deep (fig. 1). The heart section is 30 feet long and tapers from 18 feet square in front to 7 feet in diameter, where it ends with a hoop attached to the body of a standard hoop net. The crib section is seven 7-foot hoops

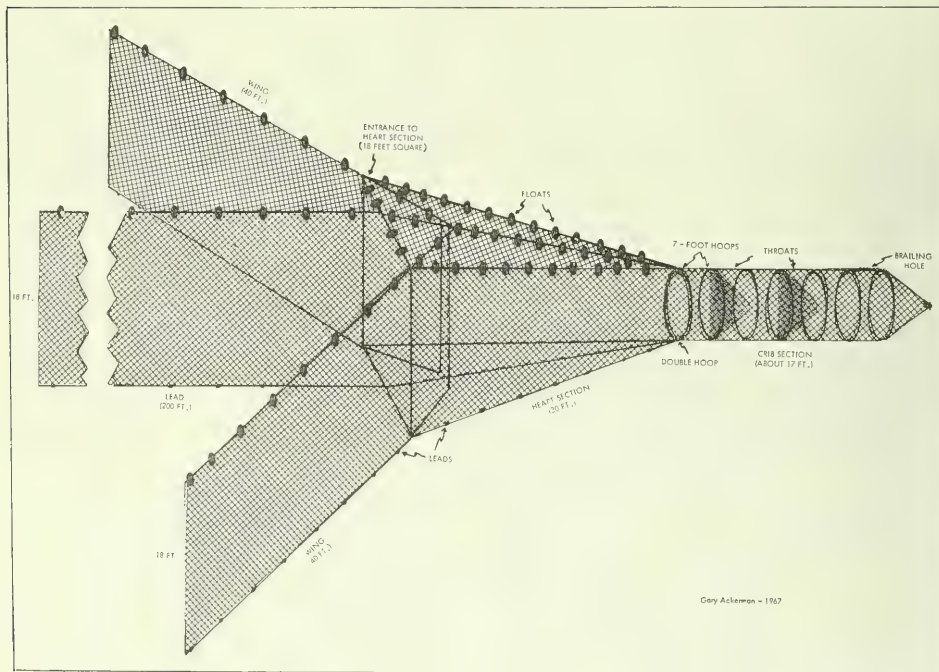


Fig. 1 - Construction diagram of floating trap net.

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spaced $2\frac{1}{2}$ feet apart. Throats are at the second and fourth hoops, and a laced brailing hole is at the top between the sixth and seventh hoops. A system of corks floats the gear, and leads on the bottom lines give it vertical stability.

Construction materials were: Webbing--No. 18 nylon thread; lines-- $1\frac{1}{4}$ -inch braided nylon; plastic floats--3 by 4 inches; leads--No. 6; and oak hoops--7-foot diameter. Mesh size throughout is 7-inch stretch measure.

Use and Results

The net was designed primarily to take bigmouth buffalo. For this reason, it is floated on the surface (fig. 2).

The lead is usually placed perpendicular to shore and from shore to net, although

"openwater" sets also are practical. The net is set by fastening the tag end of the lead to shore, stretching the lead and net out longitudinally, anchoring the crib, and then anchoring the wings in position. The crib anchor rope is 100 feet long and the wing anchor ropes are 50 feet long. The wing anchor ropes are yoked about 30 feet from the anchor with one line leading to the bottom line and the other to the float line. The gear has not been fished on the bottom, but this could be done by a change in the float-lead ratio. We recommend that the net, as now rigged, not be set in water depths over 30 feet. To fish depths greater than 30 feet would require anchor lines longer than those used at present to prevent excessive downward pull that would cause disfiguration of the net or submergence of float lines. The weight of longer anchor lines would probably require more floats at the wing and lead tips, and on the crib section.



Fig. 2 - Floating trap net in fishing position on Oahe Reservoir, S. Dak. In this set the lead extends to shore. Note floating debris--a common problem on this newly formed reservoir.

This gear is economical to fish because one man in a small boat can set, move, and fish the net. The facts that anchors instead of stakes are used to hold the net in place, and only the pot is raised to remove fish, account largely for the ease of operation.

The net caught fish effectively in two reservoirs. It was first fished commercially August 4 to 17, 1967, in Lake Oahe, South Dakota. During the 14 days of fishing, the net was lifted seven times. Bigmouth buffalo constituted 93 percent of the catch by number and weight (table). Average catch per lift was 74 buffalo with a dressed weight of 296 pounds. The catch was outstanding because August is usually a poor month for taking buffalo in Lake Oahe. Catches with the new net were considerably greater than with standard hoop nets fished concurrently in the area. The commercial fisherman later fished in Lake Sakakawea, North Dakota, and re-

Number, Dressed Weight, and Percentage Composition of Fish Taken in Seven Lifts with A Floating Trap Net in Lake Oahe, August 4-17, 1967				
	Total Catch			
	Number	Percent	Dressed Weight in Pounds	Percent
Bigmouth buffalo	519	93	2,070	93
Carp	15	3	73	4
River carpsucker	15	3	47	2
Blue sucker . . .	8	1	28	1
Northern pike . .	1	tr. 1/	8	tr. 1/
Total . . .	558		2,226	
1/ Less than 0.5.				

ported that the net continued to be an efficient gear.

The limited fishing data indicate that the net has potential as a commercial gear and is highly selective toward bigmouth buffalo. In additional testing, we suggest that baiting might improve the catch rate, especially of "openwater" sets.



THIS CHRISTMAS TREE IS SHRIMPLY DELICIOUS

In answer to many requests, the United States Department of the Interior's Bureau of Commercial Fisheries has once again released instructions for its Shrimp Christmas Tree for the most exciting holiday table in the neighborhood.

From a commanding position on a buffet table or as a colorful centerpiece for a well-appointed holiday dinner, this unusual tree is certain to capture compliments. Leafy green endive duplicates crisp holly while ever-popular shrimp add shape and color interest to this creative conversation piece.

This intriguing tree is elegant but deceptively simple. The materials are readily available at most local variety stores and supermarkets.

SHRIMP CHRISTMAS TREE

3 pounds shrimp, fresh or frozen
2 quarts water
 $\frac{1}{2}$ cup salt
4 large bunches curly endive

1 styrofoam cone, $2\frac{1}{2}$ feet high
1 styrofoam square, $12 \times 12 \times 1$ inch
1 small box round toothpicks
Cocktail Sauce

Thaw frozen shrimp. Place shrimp in boiling salted water. Cover and simmer about 5 minutes or until shrimp are pink and tender. Drain. Peel shrimp, leaving the last section of the shell on. Remove sand veins and wash. Chill. Separate and wash endive. Chill.

Place cone in the center of the styrofoam square and draw a circle around the base of the cone. Cut out circle and insert cone. Cover base and cone with overlapping leaves of endive. Fasten endive to styrofoam with toothpick halves. Start at the outside edge of the base and work up. Cover fully with greens to resemble Christmas tree. Attach shrimp to tree with toothpicks. Provide Cocktail Sauce for dunking. Serves 12.



AQUARIUM FISHES

"Unusual Aquarium Fishes," by Alan Mark Fletcher, J. B. Lippincott, Philadelphia, 1968, 143 pp., illus. The aquarium hobby is one of the largest in the world; nearly 20 million people in the U.S. alone keep fishes in aquariums. Despite this interest, few aquarists know little more than how to feed their pets. But many of the fishes commonly kept in aquariums are more than beautiful. They have habits and characteristics so bizarre as to defy credibility. There are fish that swim upside down, fish that walk on dry land, and fish that can see in and out of the water at the same time.

Mr. Fletcher offers descriptions and photographs of 35 kinds. Some of the photographs are remarkable, showing the fishes actually doing what makes them unusual.

FISHES

"A Draught of Fishes," by F. D. Ommanney, Thomas Y. Crowell, New York, 1966, 254 pp., illus., \$6.95. A distinguished marine biologist describes fish: their life, breeding, and movements; methods of fishing and fish feeding, fish as harvest, and fish as food. The techniques of trolling, trawling, and long-line fishing are graphically demonstrated. Readers who know fishing chiefly as sport will learn how fish are farmed to feed teeming populations, what is being accomplished in international cooperation in fishery research, and what we can expect in sea harvests in the near future.

FRESHWATER FISH PRODUCTION

"The Biological Basis of Freshwater Fish Production," edited by Shelby D. Gerking, John Wiley & Sons, New York, 1967, 495 pp., illus. Fresh-water fish production has made a substantial contribution to human nutrition and well-being over the years. Its contribution in the future will be vital in supplying protein to an increasing human population.

This book, a Symposium on Productivity of Freshwater Communities, stems from a technical meeting sponsored by the International Biological Program. It should be a landmark in the establishment of sound scientific principles for freshwater fish production. The Symposium is divided into 5 categories: (1) vital statistics of population, (2) relation of fish population to the food supply, (3) competition and behavior, (4) predation and exploitation by man, (5) the contribution of freshwater fish to human nutrition.

GULF OF MEXICO

"Illustrated List of Common and Scientific Names of Fish from the Gulf of Mexico, in Latin, Spanish, Russian, and English," JPRS No. 46741, compiled by Milton M. Rose, Clearinghouse, Springfield, Va. 22151, \$3.00. This is a glossary of 129 fishes from the Gulf of Mexico.

MAPS

"Seafloor Topography of the Central Eastern Pacific Ocean," Circular 291, by Thomas E. Chase, Fish and Wildlife Service, Dept. of the Interior, 1968, 33 pp. Available free from Branch of Reports, Publications Unit, 1801 N. Moore St., Arlington, Va. 22209. The offshore configuration of the floor of the eastern Pacific is presented on 26 topographic charts. Mr. Chase describes the methods and data used in their preparation and gives a general outline of the major topographic features. He has searched and evaluated all existing data pertinent to the sea floor topography, contoured the region in detail, and labeled the prominent undersea geological features.

OCEANS AND OCEANOGRAPHY

"The Frail Ocean," by Welsey Marx, Coward-McCann, New York, 1967, 248 pp., illus., \$5.95. The ocean has increasingly and, justly, come to be regarded as a vast resource--a source to be fully explored and exploited. So long as exploitation remains a key work,

however, the ocean is imperiled. This is an account of the mighty ocean and of the delicate balance that has preserved it throughout the centuries. Today that balance is in jeopardy.

Wesley Marx writes with lyric joy of the ocean's splendor, communicating his sense of wonder at its enormous power and fertility, as well as his growing fear for its future. The book makes an eloquent plea--a plea that grows more urgent with each new ocean disaster--for the preservation of the seas and their myriad inhabitants.

"Uses of the Seas," edited by Edmund A. Gullion, Prentiss-Hall, Englewood Cliffs, N. J., 1968, 204 pp. A protein harvest from the seas. Oil well 285 feet underwater. Entire submarine cities. A fantastic vehicle that gathers minerals from the ocean floor. These and other technological marvels could easily start a new era of thoughtless imperialism. Edmund A. Gullion and a group of distinguished economists, political scientists, foreign policy experts, and oceanographers urge that the U.S. explore in advance the political and military defenses against such a threat.

They also answer such critical questions as: How much can sea technology benefit the underdeveloped countries? To what extent should nations and international organizations seek to "legislate" the uses of the sea? Can sea technology affect the U.S.-USSR strategic balance? What are the consequences of British withdrawal from strategic waters? Their answers help explain the direction of American policy and the unprecedented challenges to international stability. This book was designed as a background volume for the American Assembly, a nonpartisan educational organization. It provides a wealth of thought-provoking material.

"Your Future in Oceanography," by Norman H. Gaber, Richards Rosen Press, New York, 1967, 143 pp., illus., \$4.00. This book is one of a series written for the student who is interested in choosing a major career that is more than just a job. It is written on the premise that an oceanographer must know more than his own laboratory, office, or ship. He needs a grasp of the whole discipline: of who is doing what, and why, and how.

Mr. Gaber describes oceanography, the related sciences, and marine engineering, and explains the organization, future, and business of oceanography. He lists the col-

leges and universities offering degree programs in oceanography and marine science.

SALMON

"The Atlantic Salmon. A Vanishing Species?" by Anthony Netboy, Houghton Mifflin, Boston, 1968, 457 pp., illus. Once the Atlantic salmon roamed over half the northern hemisphere, from the Arctic and Atlantic Oceans to rivers running deep into the interior of Europe and North America. In many lands it has been pursued so relentlessly--and so many barriers have been strewn along its migratory routes--that the fish are seen no more.

The species has utterly vanished from Portugal, Switzerland, Denmark, the Low Countries; it is in danger of extinction in France and Spain. Apart from the difficulties of keeping rivers inviolate, the salmon's life in the sea is now threatened by the discovery of at least part of its feeding haunts and migratory routes in the North Atlantic. Mr. Netboy has written a fascinating account of the salmon, its past, and its probable future in the countries where it still spawns. He warns of its possible extinction without some regulation of the high-seas salmon fishery.

SEA OTTERS

"Sea Otters and the China Trade," by Robert Kingery Buell and Charlotte Northcote Skladal, David McKay, Co., 212 pp. Sea otters--what are they? Few people have seen one, and almost no one is aware of the animal's place in American history. Highly valued by the ancient mandarins of China for their beautiful shimmering fur, they were the basis of a lucrative trade with the Far East that drew men to the west coast of America even before the U.S. was a nation.

The hundred years of indiscriminate hunting from 1741 to 1841 exterminated most of them. By 1841 the Russians had moved out of California and the early wagon trains were climbing over the Sierra Nevada. The dream of an America that swept across a continent was nearly a reality, but the herds of sea otter that had started the whole cycle of commerce and trade along the coast had disappeared from the kelp beds. In 1911, an international treaty was signed by Great Britain, Japan, Russia, and the U.S. protecting the fur seals, sea otters, and polar bear in the north Pacific. The authors have written a stirring tale of the sea otters and the men who hunted them.

"Sea Otter," by George Seymour, article, "Outdoor California," Vol. 29, No. 4, July-Aug. 1968, pp. 11-12, illus. Available as a Wildlife Leaflet from the California Dept. of Fish and Game, 1416 Ninth St., Sacramento, Calif. 95814. The colorful, playful sea otter is making a slow, steady comeback after being hunted to the verge of extinction. By the turn of the 19th century, after 170 years of exploitation, only a few were left along the coast of California, and in some of the islands off the coast of Alaska. There are now between 500 and 600 of these gentle creatures living along the central California coast, and 30,000 to 40,000 in Alaskan waters.

Mr. Seymour briefly describes the animal, its life history and feeding habits, and the trade that caused its near extinction.

SEAWEED

"Irish Moss--A Growing Resource," by James Kinlock, article, "Fisheries of Canada," Oct. 1968, vol. 21, no. 4, pp. 3-7, illus. Seaweeds, in particular the one known as Irish moss, are becoming increasingly important to northeast Atlantic coast fishing communities. Mr. Kinlock describes the plant, its present harvesting and uses, and its place in the plans for all Canadian regions where there is a potential seaweed industry.

"Utilization of Kelp-Bed Resources in Southern California," Fish Bulletin 139, edited by Wheeler J. North and Carl L. Hubbs, Dept. of Fish and Game, Resources Agency of California, 1968, 264 pp., illus. The general objective of this bulletin is to assess the impact of man's past, present, and future activities on the kelp-bed environment. Chief emphasis has been given to problems concerning possible effects of kelp harvesting, particularly any effects on fish life. When kelp beds regress or disappear, both kelp harvesting and fishing suffer.

The contributors examine the diets, behavior, preferred habitat, abundance, and life history of kelp fishes. They show the ecological roles played by kelp as a food source and shelter, and in phytoplankton productivity.

SHAD

"The American Shad," FL-614, by Randall P. Cheek, Fish and Wildlife Service, Dept. of the Interior, August 1968, 13 pp., illus. Available free from Branch of Reports, Publications Unit, 1801 N. Moore St., Arlington, Va. 22209. The American shad, *Alosa sapidissima*, is one of the best known fishes of the Atlantic coast. It is found from the St. Lawrence to the St. John River in Florida in sufficient quantities to support fisheries of great commercial and recreational values. Like the salmon, the shad spends most of its life in the ocean, returning to freshwater streams to spawn; like the salmon, too, it is subject to the hazards of dammed and polluted rivers and overfishing.

If annual production of shad could be restored to 19th century levels, the commercial catch would be worth more than \$6.5 million, and the sport fishery would provide many additional man-days of fishing. Mr. Cheek describes the life history of the shad, the commercial and sport fishery, and summarizes the status of research and management of the species.

UNITED KINGDOM

"Torry Research Station Annual Report 1967," Ministry of Technology, London, 1968, 50 pp., illus., \$1.30. Available from British Information Services, 845 3rd Ave., New York, N. Y. 10022. The main object of the Torry Research Station's work is to ensure that there is as little deterioration of quality as possible from the time a fish is caught to the time it is eaten. Most of the work has been concerned with handling traditional species, such as cod, and with the techniques of freezing at sea.

During 1967, station personnel investigated the merits of boxing fish at sea, superchilling, and other methods of preservation; distribution methods; quality control; prepackaging of wetfish; use and development of new machines; and preservation and presentation of nontraditional species. The Annual Report is intended for people in the fish industry and interested members of the public. Technical jargon and scientific terminology have been eliminated.

--Barbara Lundy



INTERNATIONAL

1967 World Fish Catch Sets Record

World fish catch set a record in 1967, according to the Food and Agriculture Organization of the United Nations (FAO). Marine and freshwater catch was 60.5 million metric tons, almost twice the 31.5 million caught a decade before, and more than three times the 1948 catch.

Peru, already the world's first fishing nation in quantity, became the first to take more than 10 million tons--almost all anchoveta used for fish meal. Japan was second with 7.8 million tons, trailed by the Soviet Union with 5.8 million. No information was available on Mainland China, whose 1960 catch was estimated at 5.8 million. FAO included this figure in the world catch, but assigned China no rank. Norway was 4th with 3.2 million; the U.S. placed 5th with 2.4. Canada, 1,289,800 tons, ranked 9th after South Africa, Spain, and India. Denmark broke the million-ton mark for the first time. Chile and the United Kingdom each caught over 1 million tons. Indonesia, which did not report data for 1967, had reported 1.2 million in 1966.

Nations Under 1 Million Tons

Iceland caught 1.2 million tons in 1966, but was down to 896,000 in 1967. Thailand, France, the Philippines, South Korea, and West Germany all caught over 600,000 tons. Taiwan, Pakistan, Malaysia, Mexico, Poland, Sweden, Italy, and the Netherlands each reported over 300,000.

Morocco, Angola, Argentina, the Faeroes, Senegal, Tanzania, Ceylon, Chad, Ghana, and Venezuela caught more than 100,000 tons each. Other countries that did not report 1967 data but were estimated to have caught over 100,000 tons were Brazil, Burma, Cambodia, South Viet-Nam, East Germany, Greece, Portugal, Turkey, North Korea, and North Viet-Nam. Countries with catches of less than 100,000 tons included Australia, Finland, Belgium, Romania, and Israel.

Major Species Fished

More marine herrings, sardines, anchovies, pilchards, and menhadens--19.7 million

tons--were taken than any other group. The second most important species were cods, hakes, and haddocks, followed by redfishes, basses, mackerels, and billfishes.

Latin American and Soviet fishermen caught 675,000 tons of Patagonian hake in the Southwest Atlantic, compared with 183,000 in 1966. Most of the increase was due to the Soviets, whose catches leaped from 56,000 tons in 1966 to 513,000 in 1967.

Productive Areas

The Southeast Pacific was the most important fishing area in terms of weight. It provided 11.2 million tons. The western-central Pacific was next with 10.5 million, followed by the Northeast Atlantic's 10.2 million. In the North Pacific, the total was 6.4 million tons, and in the Indian Ocean, 2.1 million. Catch from inland waters was 7.2 million tons, including salmon, eels, and other migratory species.



North Pacific Fisheries Commission Holds 1968 Meeting

The International North Pacific Fisheries Commission (INPFC) ended its 15th annual meeting at Seattle, Wash., on Nov. 8, 1968. For 3 weeks, the participants discussed aspects of international cooperation to conserve high-seas fishery resources.

Preceding the meeting, scientists from Canada, Japan, and the U.S. reviewed results of their research in 1968 on salmon, halibut, king crab, and groundfish resources. They reported their findings for the Commission's guidance. They also exchanged information on high-seas fishing during 1968.

Halibut Fishing in Eastern Bering

A principal task on the Commission's agenda was to develop halibut fishing regulations for the eastern Bering Sea in 1969. The Commission has been doing this since 1963, when line fishing there was opened to all 3 countries.

The Commission recommended continuation of 1968 conservation measures. It suggested the complete closure to halibut fishing of an extensive area in the southeastern Bering Sea, a nursery ground for young halibut. The Commission was assisted by a scientific consultant from the International Pacific Halibut Commission.

Gulf of Alaska

In the Gulf of Alaska, the Commission focused on the effects on halibut stocks of expanding trawl fisheries for other species. Groundfish catch statistics were exchanged and studied. The Commission approved recommendations by its Gulf of Alaska Groundfish Committee for further research. The Commission's Canadian and U.S. sections urged greater efforts to get more data on the interrelationship of trawl and longline halibut fisheries.

Groundfish Other Than Halibut

Considering research on groundfish other than halibut in the northeastern Pacific, the Commission considered existing bilateral regulations inadequate. It agreed to forward its findings to the 3 governments.

Tanner Crab

The U.S. asked the Commission to study tanner crab resources of the eastern Bering Sea. The Commission agreed.

Scientific Reports

The Commissioners reviewed the progress of its program to publish scientific reports. Several major papers resulting from its research were published in English and Japanese versions in the INPFC Bulletin. These included the completion of a 9-part comprehensive report on North Pacific salmon.

The next annual meeting will be held in Vancouver, Canada, beginning Nov. 3, 1969.



Nordic Conference Held on Atlantic Salmon

Delegates to the Nordic Fishery Conference, held at Aarhus, Denmark, Aug. 29, 1968, were very concerned about high-seas fishing for Atlantic salmon. Salmon have been taken for many years in the Baltic. In recent years, more than half the catch was landed by Danish fishermen.

Another high-seas salmon fishery developed recently off West Greenland. These fish could not be of Greenlandic origin because Greenland has only one salmon-producing river. It has been supposed that salmon from both Europe and North America have one or more common feeding areas in the North Atlantic. This abrupt mass appearance may be the result of the formation or extension of such a foraging area--and the fish could disappear as suddenly as they appeared.

Norway Bitter

At the Conference, Norway was especially bitter about Danish high-seas salmon fishing. She believes the Danes are reaping the rewards of Norwegian and Swedish conservation practices. Sport-fisheries salmon catch in Norway, Sweden, England, and Scotland may be of equal or greater importance than the commercial catch. Denmark's rivers produce relatively few salmon. Gear improvement--synthetic fibers for long lines--has changed a previously seasonal fishery into a year-round one.

Danish Position

The Danes claim that increased oceanic salmon fishing has not resulted in decimation of stocks, and that catch per unit of gear has not declined. They feel that exploitation has not harmed the resource. They say many countries on both sides of the Atlantic set production records after all this supposedly harmful fishing took place. Denmark expressed willingness to regulate the fishery whenever overfishing is proved.



Eastern Pacific Tuna Catch Reported by IATTC

The total tuna catch in the convention zone, Jan. 1-Oct. 28, 1968, was 109,586 short tons of yellowfin and 64,512 short tons of skipjack, reports the Inter-American Tropical Tuna Commission (IATTC).

The annual bait-boat catch rate of 4.70 tons of yellowfin and skipjack per day was the lowest in 5 years. The catch rate by purse seiners on nonregulated trips remained high; the yellowfin rate, at 8.55 tons per day, was the highest in 5 years.

The skipjack catch rate of 3.24 tons per day was lower than 1967 but higher than 1964-1966. Purse seiners on regulated trips--after yellowfin quota had been reached--caught a daily average of 4.7 tons of skipjack and 0.74 ton of yellowfin.



Oil Pollution International Conference Held

A global pact to control the growing menace of all forms of marine pollution, including oil, dumping of pesticides, and radioactive wastes, industrial discharges of toxic chemicals, and normal sewage discharge has been urged by Roy Jackson, FAO's Assistant Director General. He spoke at the Third International Conference on Oil Pollution of the Sea in Rome, Italy, Oct. 7, 1968.

He said international legislation must forestall not only "accidental" pollution, as in the Torrey Canyon disaster, but all types, including release of "potential pollutants" and "deliberate use of ships to discharge pollutants into seas and coastal areas."

Calls for International Convention

He said it was time to consider a convention to report discharges, and to control, restrict, or prohibit deliberate discharging of specified noxious substances.

Such a pact, Jackson added, should provide for a permanent commission to monitor, enforce, and to identify "particularly noxious substances" and means to control them.

1958 Geneva Conventions

He noted that the United Nations Geneva Conventions of 1958 on the law of the sea cite pollution but do not provide for reporting or control. The oil pollution convention of the Inter-governmental Maritime Consultative Organization does not provide proper standards for pollution control.

FAO will call an International Conference in 1970 to discuss the effects of pollution on fishing.



Conference on Fish Meal

The 8th Annual Conference of the International Association of Fish Meal Manufacturers (IAFMM) in Bremen, West Germany, Sept. 30-Oct. 4, 1968, was attended by fish meal industry representatives from 18 countries. They heard the latest information on current and potential production, consumption trends, and activities to aid marketing.

In the keynote speech, Dr. Gerhard Meseck, West German Ministry of Food, Agriculture, and Forestry, said his studies showed that the world's fish meal production could be raised to 7 to 8 million metric tons before the year 2000. Current problems of unbalanced supply and demand were attributed to the main producers' lack of market experience. The needs for business stability, and for a effective catch utilization in such products as fish protein concentrate for human consumption, were emphasized.

Variety of Specialists

Brokers and importers discussed quality and market problems. Scientists and nutritionists exchanged information on ways to process and market a high-quality product. Future prospects for production and marketing were outlined.

IAFMM members are Belgium, Canada, Chile, Denmark, France, W. Germany, Iceland, Morocco, the Netherlands, Norway, Peru, Portugal, South Africa, Sweden, the U.K., and the U.S.

The next meeting is scheduled for October 1969. An Executive Council meeting will be held in Madrid immediately after. The Scientific Committee meets in Amsterdam, April 9-10, 1969.

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Japan & Australia Agree on Fishing Inside 12-Mile Zone

Negotiations on Japanese fishing in Australia's 12-mile zone were concluded in mid-September 1968. The agreement, to take effect in spring 1969, covers a 7-year period (3 years for coastal areas of Papua and New Guinea, which become independent in 1971).

Japanese tuna vessels will be permitted in traditionally fished areas in the 12-mile zone, except in waters between Sydney and Brisbane, and a section off Tasmania's west coast. Fishing effort will be permitted at the present level of about 6,000 tons a year. Four ports will be open to Japanese vessels. Each vessel will be assessed about US\$100 annually. ("Suisan Tsushin," Sept. 21, 1968.)



USSR Seizes Japanese Vessels

On Sept. 28, 1968, the USSR seized 2 Japanese fishing vessels with 17 crewmen near Etorofu (Iturup) Island in the southern Kurils. When the Japanese protested the seizures and inquired about the crewmen, the Soviet Foreign Office gave them a list showing 16 crewmen and denied that one had been injured during the incident. After Japan asked about the 17th man, the Soviets admitted they were holding 17.

In another incident, the USSR notified Japan on Oct. 12 that she would release 10 fishermen seized off Shikotan Island in late August 1968. What happened to their 2 vessels is not known.



Japan-USSR Meet to Assess Pacific Saury Stocks

In September 1968, biologists from Japan and the USSR held a 5-day study meeting aboard the Soviet factoryship 'Pavel Chebotnyagin' anchored off Japan. They discussed saury stocks and migration and agreed that saury abundance in coastal waters has declined.

Japan believes there are two groups of saury, one spawning in spring and the other in fall; Soviet biologists believe there is only one.

The next study meeting may be held in Japan. ("Shin Suisan Shimbum," Sept. 30, 1968.)



Japanese Explore for Tuna Off Chile

The 340-gross-ton long-liner 'Azuma Maru No. 31,' exploring for tuna off Chile, completed her second cruise in mid-September 1968 and called at Valparaiso to reprovision. Now on her third trip, she is seeking southern bluefin in the area bounded by 35°-45° S. latitudes and 80°-85° W. longitudes and has already taken four (total weight 792 lbs.).

In the first 2 surveys, good big-eyed tuna catches were made in the upper latitudes. Fishing by several long-liners has begun in that area. Azuma Maru's catch, late May to early October: 155 tons of tuna; big-eyed 106.9 tons, or 69%; a l b a c o r e 23.3 tons, or 15%; and others, including six bluefin, 24.8 tons, or 16%.



South Koreans and Japanese Agree to Study Problems

A ministerial conference between South Korea and Japan was held in Seoul in late August 1968. The ministers agreed to establish an Agricultural and Fishery Technical Cooperation Committee to study technical exchange problems and to exchange fishery specialists.

South Korea wants Japan to liberalize fishery imports from Korea. The Japanese agreed to study the problem because of Korea's need to expand her fishery exports. Both nations are pleased with the surveys for development of fish-culture projects on and off the Korean coast, and the plans to develop shallow sea areas and tidal flats.



U.S.-USSR Groundfish Survey Conducted Off Mid-Atlantic Coast

In mid-November 1968, the Soviet research vessel 'Blesk' and BCF's 'Albatross IV' completed the first joint survey made under the Mid-Atlantic Fisheries Agreement from Cape Cod, Mass., to Cape Hatteras, N. C. The survey's purposes were to determine autumn distribution and relative abundance of groundfish, and to evaluate relative efficiencies of each country's standard survey trawls.

Blesk's Second Survey

The Blesk then was scheduled to study stocks and distribution of red and silver hake on Georges Bank and Nantucket Shoals and to return to Kaliningrad on Dec. 18, 1968.

In late September 1968, Canada's research vessel 'Theta' joined the U.S. and Soviet vessels for a plankton survey in ICNAF subarea 5.



U.S.-Japan Fisheries Conference

On Nov. 13, 1968, in Washington, D. C., U.S. and Japanese officials began a review of 2 fishery agreements. The first agreement, signed in 1964, regulates king crab fisheries in the eastern Bering Sea. The other, signed in 1967, concerns fishery problems off the U.S. coast.

The 2 delegations examined operation of the agreements in the light of current problems and developments in the fisheries.

The U.S. delegation, including representatives from Alaska, Washington, Oregon, and California, was led by Ambassador Donald L. McKernan, Special Assistant to the Secretary of State. The Japanese delegation was headed by Minister Bunroku Yoshino of the Japanese Embassy.



U.S.-USSR Scientific Meeting

BCF scientists and representatives from Washington, Oregon, and Alaska met with Soviet scientists in Moscow in October 1968. They exchanged information on research on northeastern Pacific groundfish stocks--Pacific ocean perch, hake, and shrimp--and planned a coordinated research program. The

meeting was held under the U.S.-USSR Feb. 1967 agreement on fishing in the northeastern Pacific off the U.S. coast.



Norwegian Canning Plant Slated for Shetlands

The Shetland County Council has agreed to back financially a Norwegian fish cannery on the Island of Yell. The decision sparked a major row over foreign interests getting preference over local and British companies. Norwegians have proposed a canning plant; local groups offered a freezing plant. Council felt a cannery would add more to the industry. The local company, Shetland Seafood's, still may proceed with its plans. Either proposal would provide possible employment for 30-40 people.

Much interest has been shown in developing the shellfish trade, particularly crab and lobster. ("Fishing News," Sept. 1968.)



Conference on Oceanology to be Held in U.K.

Oceanology '69, the first international conference and exhibition on oceanology in western Europe, will be held at Brighton, England, Feb. 17-21, 1969. A major international conference on ocean science and engineering will be held concurrently with the exhibition.

The National Council on Marine Resources and Engineering Development will direct U.S. participation in the conference. Plans have been made by a working committee of representatives from agencies having substantial interest in oceanology. Papers will be presented by leading U.S. oceanographers and government officials, including a U.S. Senator. U.S. Exhibit Large

The U.K., Canada, Japan, France, Germany, and the Soviet Union are planning exhibits. Over 30 American firms prominent in oceanology will offer the following products and services of particular interest to the fishing industry: fish protein concentrate plants; research submarines; submersible motors; equipment; oceanographic and cargo winches; undersea habitats; and acoustic equipment.

FOREIGN

CANADA

WORLD'S LARGEST SALMON-REARING STATION OPENS

The world's largest Atlantic salmon rearing station was opened in October 1968. The C\$3.5-million Mactaquac fish culture station, on the St. John River just below the site of the Mactaquac hydroelectric development, is the first of its type in North America.

Construction of a 600,000 kw. power dam will interfere with Atlantic salmon migration both ways on the St. John. The station will raise enough Atlantic salmon to perpetuate the runs. Total salmon run in the St. John has been estimated at 10,000 to 20,000. The fish will be trapped in collection facilities at the dam site, about 1,000 kept as brood stock, and the rest transferred by specially designed tank trucks to the waters above the dam to support angling and natural reproduction on the upper St. John. The station will also support a commercial salmon fishery in the lower regions of the river and in the Bay of Fundy.

Production Has Begun

Mactaquac began producing on a trial basis last fall. Hundreds of thousands of tiny salmon, which emerged from the egg stage last January, have been raised to the smolt or sea-going stage. They will start their downstream run soon. This is only the start of a large operation designed to produce 500,000 young salmon. (Canadian Dept. of Fisheries.)

* * *

NEW RULES SET FOR B.C. SALMON FISHING

New regulations increasing the earning power of British Columbia salmon fishermen and permitting more effective management of the salmon resource will be effected in 1969. The size of the fishing fleet will be limited, which should reduce production costs. Vessels presently fishing for salmon will not be deprived of fishing rights. Anyone will still be able to buy and sell salmon vessels.

The new regulations place vessels in two categories, based on commercial landings either in 1967, or in this year up to Sept. 6. In both categories, transfer of vessel ownership will be allowed; and the salmon fishing license will accompany the vessel.

Vessels in the first category are those with a 10,000 pound or more production of pink or chum salmon or the equivalent in other species, based on the following formula: 1 lb. of sockeye or coho equals 3 lbs. of pinks or chums; 1 lb. of spring salmon equals 4 lbs. of pinks or chums. This would be equivalent to about C\$1,250 landed value.

Licenses for "A" category vessels will be renewable annually. If a vessel is to be newly licensed, it must replace an A category vessel.

The "B" category includes vessels producing less than 10,000 lbs. of pink or chum salmon or the equivalent. They may renew licenses annually, but they cannot be replaced by a new vessel. Most vessels in this category are small and, in terms of commercial catch, they provide about 1% of total salmon production value.

Vessels licensed for salmon in 1967 or 1968 that did not record any commercial landings in 1967, or prior to September 6 in 1968, will not be licensed in 1969.

The salmon license of a vessel removed from the fishery by loss at sea will be cancelled and cannot be replaced.

To increase the value of the salmon fishing privilege, the license fee will be increased from C\$5 to \$10 in 1969. As the fishing privilege becomes more valuable because of fleet size reduction, license fees will be further increased. Current cost to salmon fishermen is \$20--commercial fishing vessels registration, \$10; validation for salmon fishing, \$5; personal fishing license, \$5.

The new measures supplement the conservation and research programs that are ensuring a continuing and increasing supply of salmon. (Fisheries News, Dept. of Fisheries of Canada, Vancouver.)

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Canada (Contd.):

TUNA CATCH IS UP

Tuna landings through September 1968 were 1,952,000 pounds; in the 1967 period, 122,000 pounds. Development of this industry has been difficult. Several disputes have occurred over labor matters and government policies.

In September, tuna were selling for C\$350 a short ton in Vancouver. ("British Columbia Fish Marketing Report.")

* * *

1968 MAY PROVE GOOD FISHING YEAR FOR ONTARIO

Production in first-half 1968 indicated a good year for Ontario commercial fishing: 22.5 million lbs. of fish yielded a gross return of C\$2.3 million. By the end of June, landings were 3 million pounds more and C\$89,000 above landings at mid-1967.

Species

Landings increased in all Great Lakes waters except Lake Huron proper. There were increases in 19 of the 25 species comprising the catch; these included the premium whitefish, walleye, lake trout, and sturgeon. Smelt landings showed the greatest change, increasing from 4.6 to 7.5 million lbs. Yellow perch was 7.8 million lbs., and walleye 1 million.

Lake Erie Perch

An 8% decline in the perch harvest from Lake Erie was due to new controls imposed to solve the problem of oversupply. A slight price decline, coincident with smaller landings, depressed the value of the perch catch for first-half 1968 by 11% from 1967.

Perch are abundant in Lake Erie and fishermen were not expected to have difficulty taking the quota for the second half. (Ontario Dept. of Lands and Forests.)

* * *

EXPLORATORY FISHING IN LAKE ONTARIO

A 5-month program to determine if smelt and alewife stocks in Lake Ontario will support a commercial trawl fishery was completed in December 1968. The program

investigated markets for the species and delineated grounds over which bottom trawling is physically feasible.

Methods & Results

Canadian waters of the lake were subdivided into sampling areas of about 50 sq. miles. These were searched with a fish-detection echo sounder. Radar was used to maintain the vessel on the search pattern's predetermined courses. Trawl tows were made where sizable schools were found to determine their sizes and species. A biologist was aboard to direct operations and to record and interpret results.

Findings suggest that the lake's eastern basin has the greatest concentrations of alewives and smelt. (Ontario Dept. of Lands and Forests.)

* * *

MIDYEAR REPORT ON MARINE OILS & FISH MEAL

Marine oil production during first-half 1968 was 27.5 million pounds, 16% more than the 23.7 million produced in the 1967 period. Most of it was herring oil, the rest small quantities of seal, whale, and other marine oils. The greater part of herring oil is used to manufacture margarine; the remainder is used for shortening oil.

Marine Oil Exports & Imports

Marine oil exports declined 61.3% during the first 7 months; imports dropped 65.1%. As a result, Canada has a favorable trade balance of 975,000 pounds, compared with a favorable balance of 1.8 million for the same period in 1967.

Fish Meal Production

Fish meal production during first half was 94.8 million pounds, 21.5% more than the 78 million of first-half 1967. Total 1967 fish-meal production was about 196 million pounds.

Fish Meal Exports & Imports

From Jan.-July 1968, fish-meal exports increased 38.7% to 19.2 million pounds. The U.S. bought 63.8%, compared with 28.3% for the first 7 months of 1967. Imports during the same period were 2.6 million pounds;

Canada (Contd.):

none was imported in 1967. (Foreign Agricultural Service, Ottawa, Canada.)

* * *

TESTS MIDWATER TRAWLING

Midwater trawl operations using a stern ramp vessel are being sponsored jointly by federal and provincial governments and industry.

In mid-September 1968, a 156-ft. stern ramp trawler, the "J. B. Nickerson," landed a record 427 short tons of herring at Pubnico, Nova Scotia. She made the catch in 30 hours and 12 tows on Orphan Bank in the Gulf of St. Lawrence. From Aug. 19 to Sept. 12, the vessel landed 1,652 tons of herring, amply demonstrating the method's economic potential for stern trawlers.

Large quantities of herring are taken by purse seiners operating over huge schools of fish. Midwater trawling is performed during daytime, when herring are dispersed and too deep for successful purse seining. (Canadian Dept. of Fisheries.)

* * *

ACCEPTS NEW ICNAF REGULATIONS

Canada has accepted changes in regulations governing fisheries in the northwest Atlantic. She and the 13 other members of the International Commission for the Northwest Atlantic Fisheries (ICNAF) are concerned about the effects of heavy fishing on the fish stocks.

The new regulations will include additional species of fish under conservation measures establishing minimum mesh sizes for the nets used. Cod and haddock have been regulated for years. The minimum mesh sizes, ranging from $4\frac{1}{2}$ to 5 inches, depend on the area being fished and the type of gear used and are designed to permit the escapement of fish under commercial size.

Flounders, Halibuts, Redfish

Flounder will be regulated in all ICNAF fishing areas northeast of, but not including,

Georges Bank off New England to the coast of Labrador, in the minimum mesh-size regulations. In the Grand Banks area which extends westward and southward more than 600 miles, halibut and Greenland halibut are included in the regulations. In the northern section of the Grand Banks, redfish come within the minimum mesh-size restrictions.

Nations Police Their Nationals

To administer the 200,000 square miles of ICNAF waters, there are 5 subareas. The present control system makes each nation responsible for enforcing ICNAF regulations for its own nationals. Canada, for instance, sends patrol vessels to the fishing banks with authority to board Canadian fishing craft. At the landing docks, officers of the federal Department of Fisheries Conservation and Protection Service board Canadian fishing vessels to check mesh sizes.

14 ICNAF Member Nations

Canada was an original signer of the international convention set up almost 20 years ago. There are now 14 member nations: Canada, Denmark, Germany (Federal Republic), Iceland, Italy, Norway, Portugal, Poland, Romania, Spain, the U. K., the U.S., and the USSR.

* * *

DISCONTINUES FISHING GEAR INSURANCE

Canada's experimental low-cost federal insurance, covering fixed fishing gear such as weirs, fish traps, working and storage buildings (and the equipment stored in them), has been discontinued. Losses were greater than expected. The plan ran at a deficit because not enough fishermen participated.

During 1967-68, fishermen, mostly in Newfoundland and Nova Scotia, purchased 350 policies with an insured value of C\$718,295. In the same period, claims amounted to \$26,313, and premiums only \$7,089.

Existing policies will be honored but not renewed.



EUROPE

Norway

CATCH DROPS 18%

Norway's catch from Jan.-June 1968 was 1.4 million tons, down 18% percent from the 1.7 million landed in the 1967 period. The decline was due to lower landings of herring, mackerel, and saithe. Capelin catches increased about 20%. Most of the catch--78% percent--was used for reduction. ("Fiskets Gang.")

* * *

WHALING INDUSTRY FADES AWAY

Kosmos--the only Norwegian company that whaled in the Antarctic in 1967--called it quits in 1968. It marked the end of an industry which brought prosperity to the whaling center of Sandefjord, south of Oslo.

High costs, worn-out facilities, and poor markets were major reasons for the decision. The firm would have needed a US\$4 million investment to meet competition from other countries, primarily Japan.

A company spokesman stated: "With the development that whaling in the Antarctic has undergone. . . limited catching periods and greatly reduced stocks. . . it would be indefensible to rebuild the large Norwegian whaling fleet." (U.S. Embassy, Copenhagen.)

* * *

STOCKFISH SUBSIDIES

In September 1968, the Norwegian government proposed a US\$8.4 million support for the stockfish industry. About half was to be used for state purchases of 5,000 metric tons of unsold stockfish from 1967 production, and the other half for interest-free loans to purchase 1968 production. Norway probably will offer the fish to the World Food Program and/or other humanitarian programs. She did this with the 4,000 tons purchased in spring 1968.

This appropriation is in addition to the US\$16.8 million extraordinary support measures for the stockfish industry adopted during the past 12 months. The degree of state sup-

port extended to the stockfish industry is illustrated by the fact that the total export value in 1966, the last normal year, was US\$21.8 million. Very little stockfish is sold for domestic consumption.

Marketing Conditions Abroad

Increasing competition and general deterioration of marketing conditions abroad for some of Norway's major fish products gained further momentum in 1968. The civil war in Nigeria, Norway's most important market, reduced deliveries to a fraction of normal levels; and Mexico banned klipfish imports. Prices abroad declined for several major fish products--frozen fish filets, shrimp, and marine oils. Export statistics for first-half 1968 showed reduction in quantities and values of 3.6% and 19%, respectively, to 390,000 metric tons and \$99 million, compared with the 1967 period.

Domestic Repercussions

The poor overseas market conditions, temporary stoppages of fishing for certain species in various districts, reduced incomes and profits and caused several bankruptcies among processors/exporters. The Fishermen's Union, several local unions, and fishermen's marketing organizations blamed the exporters for failing to exploit marketing opportunities, and for the price-depressing competition overseas. They all recommended that full centralization of fish exports be enforced under the 1955 Law on Fish Exports.

Conditions in Finnmark

The province of Finnmark, in the far north, was particularly affected by marketing disruptions; its economy is almost completely geared to fishing. The province is the principal producer of so-called "African quality" stockfish, so the reduced deliveries to Nigeria aggravated her problems. Finnmark's crisis may be largely local, rather than coastwide. The communities particularly affected were the smaller ones, where landings are used for dried and salted products--stockfish and klipfish. The stockfish industry cut purchases of raw fish to 11,300 tons, about one-third the 1967 level, and the klipfish industry by 39% to 4,300 tons from Jan.-mid-Sept. 1968. The small size of most boats from

Norway (Contd.):

the smaller villages prevented fishermen from delivering catches to ports where there was still a market.

The picture was quite different in communities with frozen-fish filleting and reduction facilities, although 1968 prices both for fishermen and in export markets were lower than in 1967. Finnmark frozen-fish filleting plants bought a record 61,200 tons from Jan, through mid-Sept, 1968, 44% more than in the 1967 period. Fish used for filleting results in products bringing much higher prices per unit of raw fish used than fish processed into stockfish and klipfish. Deliveries to Finnmark's reduction industry have set a record in 1968. Capelin catches reached more than 520,000 tons, and 318,000 tons of fat herring had been landed by mid-September. This means that Finnmark's fish meal and oil industry must have been working at full capacity since early spring.

* * *

EXPORTS FISH PROTEIN CONCENTRATE

Norway has shipped her first fish protein concentrate (FPC) for human consumption. The shipment, from Skude Fishkemelfabrikk near Haugesund, was 3 metric tons of fish meal (probably herring or mackerel meal) packed in 25-kg. paper sacks to be marketed in Cameroun.

There is some reason to believe that Skude Fishkemelfabrikk FPC is based on conventional gasoline extraction of fat using fresh fish raw material.

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MANY DOGFISH CAUGHT ON GEORGES BANK

The 'Arnfrid Leonora' returned to Bergen, Norway, in November 1968 with a 75-80-ton catch of dogfish taken on Georges Bank off the Massachusetts coast. The vessel, at sea for two months, found good stocks of "large, fine dogfish of the best quality" on the Bank. Fishing was most effective at 10 to 30 fathoms. She was the only vessel seeking dogfish, although large numbers of foreign vessels were fishing on the grounds.

Sales on European Market

Dogfish are taken on longlines fished near the bottom, and as incidental catch in bottom trawling. Norway takes about two-thirds of Europe's 30-40 thousand ton annual catch; U. K. takes most of the remainder. Fresh dogfish and smoked pieces of back and belly flesh go primarily to Germany and the U. K.

In Germany, the flesh is smoked and packed in gelatin as a semipreserved product, canned in oil, or sold as "seeaal" (ocean eel) and "schillerlocken."

In Denmark, fresh, skinned dogfish is sold as "kongeaal" (king eel). Properly prepared, dogfish have a fine, delicate flavor.

U.S. Opportunities

U.S. fishermen might be able to sell the countless tons of dogfish they take as incidental catch. The market on the Continent was excellent, but heavy British landings were limiting sales possibilities there.



Denmark

RECORD YEAR IS LIKELY FOR FISHING INDUSTRY

It is likely that fisheries will set a record in 1968. Fishermen received 50 million kroner (US\$6.7 million) more during the first half than in the same period of 1967. A record year was also expected for exports. If good weather held, they would exceed one billion kroner (\$133 million), an increase attributable to excellent weather and heavy landings of industrial species.

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MORE SUBSIDIES RECOMMENDED IN GREENLAND

The fisheries, Greenland's major industry, are in trouble and local legislators say further subsidization is the only solution.

Cod usually provides about two-thirds of Greenland's landings; the catch for the first 7 months of 1968 was down about 35%. The

Denmark (Contd.):

catch failed catastrophically in the major ports; in Holsteinborg, the hardest hit, it dropped more than 80% from 1967. Many fishermen fear they will be unable to meet payments and lose their vessels. Catches of seal also dropped.

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NORWAY DELIVERS VESSELS
TO THE FAROES

Norwegian yards delivered 2 fishing vessels, a shelter-deck long-liner and a power-block purse seiner, to Faroese owners in September 1968.

The long-liner, 'Leivur Hepni,' is 160 ft. long, has a 1,200-hp. diesel main engine, and can cruise at 13.3 knots. The covered and heated work deck makes it easier for the 27-man crew to work distant grounds off Greenland and Newfoundland.

Another Faroese long-liner, the 'Isborg,' is being equipped with refrigerated seawater (RSW) tanks in Norway. The vessel will be used to supply the European market with fresh herring. She is 196 ft. long and has a covered and heated work deck.

The Purse Seiner

The purse seiner, "Solborg," is 138 ft. long and has a 1,200-hp., 4-cycle, V-type diesel main engine directly coupled to a variable-pitch propeller. She has 2 side-thruster propellers, a pair of 63 kw. motor generators for auxiliary power, and comfortable cabins for the 17-man crew. She is equipped with the most modern hydraulic deck gear, and electronic navigating and fish-finding equipment and dual sonar and radar. She also has 2 RSW tanks subdivided into 3 tanks each. The smaller sections can be used separately, or they can be connected by open hatches to simplify loading when catch is landed for industrial purposes. Solborg will catch herring for British and Continental fresh-fish markets.

Fresh Herring Not Fish Meal

The low prices Faroese fish-meal plants were paying for raw material spurred the interest in RSW-tanked purse seiners. RSW tanks make it possible to deliver herring suit-

able for human consumption to a number of North Sea ports, especially in Denmark, Germany, and Scotland. The conversion of big Faroese long-liners to power-block sein-ing for industrial-quality herring may shortly be followed by conversion to fishing for food-quality herring using RSW tanks. Norway and Denmark also are interested in RSW-preserved herring, a development welcomed by those who consider herring too good for fish meal.

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LAUNCHES FIRST FLOATING
FISH-MEAL PLANT

A 30-year-old Danish patrol and rescue vessel--renamed 'Helsing'--has been converted to a fish-meal factoryship capable of processing about 75 tons of fish every 24 hours. The owners have invested US\$266,000 to produce high-quality fish meal for mink feed. Because this requires first-quality raw material, they are "taking the factory out to the fishing grounds."

The fish-meal plant is a fully automatic 'compact' model produced by Dan-Thor.



Spain

WINS 7TH PLACE IN WORLD CATCH

Fish production in Spain continued upward in 1967 and won her seventh place worldwide in volume of production, and fifth in value. The official fish catch was 1,428,780 metric tons, with a first-sale value of US\$330.9 million. This was an increase of slightly more than 4% over 1966's 1,371,000 tons. The high value is explained by the relatively high percentage (16%) of shellfish in the total catch.

Fleet Grows

In 1961, Spain enacted the Law for the Renovation of the Fishing Fleet. From 1961 through March 1967, fleet tonnage increased from 270,000 to 484,000 gross registered tons. Credits for fishing vessels granted exceeded US\$100 million.

This trend is continuing. During 1967, 288 new fishing boats entered service.

Spain (Contd.):

As of March 1968, 140 fishing vessels were on order in Spanish yards (most over 100 tons and steel-hulled), including 79 long-range, 31 freezers, and 30 cod vessels. The improvement has been concentrated in the long-range fleet, while the coastal fleet has deteriorated. Official efforts are underway to reverse this deterioration but are handicapped apparently by lack of sufficient official credit.

Long-Range Fleet

The shift to the long-range fleet has meant a shift in type of species landed, with important consequences for the domestic market. Offshore fish important to the packing industry, such as anchovies and tuna, have been declining, while frozen fish and cod from the long-range fleet increase.

Demand for frozen fish does not match increasing supply. The problems are consumer preferences and insufficiency of refrigerated storage facilities. The Ministry of Commerce is actively promoting the Refrigeration Expansion Plan for medium-sized warehouse and at retail level.

Per-Capita Consumption Up

Per-capita fish consumption increased from 38 lbs. in 1964 to 44 lbs. in 1967. Expansion of refrigeration facilities will tend to even out extreme differences in consumption rates between provinces. (U.S. Embassy, Madrid, Sept. 25, 1968.)

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FACES PROCESSING TROUBLES

Processed fish reached a record value of slightly over US\$100 million in 1966, but it remained the only sector of the fishing industry that fell far short of planned goals. This was due mainly to failure to modernize and consolidate small and inefficient plants, and to insufficient supplies of the fish most in demand. During the last 2 years, landings for processing have declined, in absolute and relative terms.

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WEST AFRICAN FLEET IS REDUCED

White fish catches by Spanish trawlers off the coast of South-West Africa had dropped by Sept. 1968 from about 30 tons per-day per-vessel to 10. Seasonal scarcity of white fish, especially hake, caused the reduction.

Off South America

Fifteen Spanish vessels were fishing off Argentina, Chile, and Peru. Catches were reported good, although the fish were smaller than those in South-West Africa catches.

Markets

Meanwhile, the fish glut on the Spanish market had ended. Some frozen fish was sold to the U. K. and marketing prospects in Japan were being investigated.

Transshipments

The bigger trawlers off the South-West African coast returned to Spain after filling their holds, instead of transshipping to reefers. Only the smaller ones were transshipping at Walvis Bay. ("South African Shipping News and Fishing Industry Review," Sept. 1968.)



USSR

STUDIES COMMERCIAL DEEP-WATER TRAWLING

The 'Akademik Berg' of the Pacific Fisheries and Oceanographic Research Institute has been in the northeast Pacific since mid-August 1968 investigating pelagic fishery resources between 900 and 6,000 ft. (300-2,000 m.) and trawling to 6,000 ft. (2,000 m.). Earlier explorations indicated commercial concentrations of fish at these depths. In the Barents Sea, the Murmansk trawler fleet was reported trawling on a commercial scale as deep as 2,700 ft. (900 m.).

In the North Atlantic

In 1961, the Soviets began deep-sea fishing on Georges Bank and in the Norwegian Sea at 1,800-2,100 ft. (600-700 m.). In 1965,

USSR (Contd.):

the Latvian fleet made good catches while deep-water trawling off the Grand Banks; in 1966, Kaliningrad vessels also tried deep-water trawling there.

In 1968, in the North Atlantic, researchers aboard the 'Aisberg,' 'Okeanograf,' and 'Professor Vize' have been studying the dynamics and thermics of water masses to 3,000 ft. (1,000 m.). The Polar Fisheries and Oceanographic Research Institute, using data gathered during 3 years of hydrobathographic research, is preparing a map of North Atlantic deep-water regions having commercial concentrations of fish.

North Pacific and Bering Sea

In 1962, the exploratory research vessel 'Adler' trawled at 600-2,100 ft. (200-700 m.) for halibut, oceanperch, and sole in the Bering Sea, off the Aleutians; she caught 2.5 metric tons of halibut and 8 tons of perch in 1 hour. In 1963, catches by 'Ogon' at 1,200-2,100 ft. (400-700 m.) in the Bering Sea occasionally exceeded catch in shallower waters. Later that year, 3 large stern trawlers began commercial deep-water trawling in the North Pacific and the Bering Sea. In 1964, 'Akademik Berg,' trawling in the Bering Sea at 3,000 ft. (1,000 m.), reportedly caught 50 tons per fishing day; in 1966, she was back again, trawling at 1,200-4,500 ft. (400-1,500 m.) for halibut and sable fish.

Barents Sea

In 1964, the exploratory trawler 'Treska' found commercial concentrations of turbot at 2,850 ft. (950 m.) near Bear Island in the Barents.

Kuril Trench

In 1966, 'Vitiáz' explored the Kuril Trench and collected data on the fauna and biology to 27,000 ft. (9,000 m.). She reported large catches of fish to 10,500 ft. (3,500 m.).

Technical Problems

The Soviets can fish to about 2,700 ft. (900 m.), but they cannot fish much lower. Although all surveys since 1963 have indicated fish concentrations at lower depths, the problems caused by enormous pressure on the gear at lower depths are staggering.

* * *

SHRIMP RESEARCH IN
THE PERSIAN GULF

Kuwaiti shrimp fishermen in the Persian Gulf, using small vessels with double trawling gear, land 30-61 metric tons of shrimp tails per month per vessel. A try net is used to locate good areas. The average daily shrimp catch of a Soviet SRTM is 0.693 ton; the Kuwaiti vessel's is 0.669. This has prompted the Soviets to study shrimp biology and fishing techniques to find improved trawling methods.

Weather Conditions

The best Soviet hourly trawling catches, 0.3-0.4 ton, were obtained during westerly winds and the first 3 or 4 days of calm thereafter. Then, the shrimp moved into shallower waters, where they could not be fished. These observations were not double-checked in 1966/67 when southeasterlies prevailed.

Tidal Conditions

Tides and moon phases also affect catch size. In 1966/67, shrimp catches were highest during full moon and new moon periods, except in late December and early January, when molting shrimp prevailed. Daily catches also increased during the tide change.

Effect of Black Croakers

Black croakers, 'Sciaena,' cause shrimp to move away. During 1 hour, in 1966, a processing trawler caught 0.2-0.25 ton of shrimp; several days later, after sighting many black croakers in the area, catch per hour dropped to only 100 shrimp. Examination of 'Sciaena' stomachs revealed they had fed exclusively on shrimp.

Temperature Variations

Temperature variations can affect shrimp catches. The best catches occurred at bottom temperatures between 24 and 26° C. (75.2-78.8° F.) in December, and 23° C. (73.4° F.) in January. No shrimp were caught at temperatures below 20° C. (68.0° F.).

Results

The Soviets have decided that shrimp fishing in the Persian Gulf should be done with small vessels equipped with double trawls and a try net. Shrimp vessels should deliver catches to floating bases, like BMRTs, with

USSR (Contd.):

fish-meal producing facilities. Fish caught incidentally to shrimp fishing could be processed into meal. Trawling should be done during a full moon or new moon, during the daily change of the tide, with westerlies, and during the 3 or 4 days of calm that follow. Shrimp fleets should include an exploratory vessel to discover new commercial concentrations, to direct the fleet to them, and to make hydrometeorological observations. ("Rybnoe Khoziaistvo," No. 7, 1968.)

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FISHES MACKEREL OFF JAPAN

Soviet fishing for mackerel off eastern Hokkaido is expanding. In Sept. 1968, 33 fishing vessels, 4 factory motherships, and 1 refrigerated transport were sighted around 43° N., 147° E., catching and canning mackerel. The Soviets use purse seines on converted medium side trawlers. One source reported as many as 100 vessels divided into 6 fleets.

In 1967, 6 medium side trawlers and 4 seiners caught 9,000 metric tons in 2 months off the South Kurils and Hokkaido.

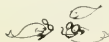
At last report, the Soviets were investigating sonar tracking of mackerel schools and the use of lights for night fishing.

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AIDS DEVELOPING COUNTRIES

In early 1968, the Soviet Union was helping 18 countries to develop marine fisheries--Burma, Iran, Uganda, Guinea, Somalia, Kenya, Cameroon, Cuba, the United Arab Republic, and others. There were 450 foreign fishery students in the USSR at that time: in university and technical institute postgraduate programs, training with fishery firms, and on board fishing vessels.

In 1966-67, about 150 foreign students graduated from Soviet fishery schools. Several years before, Kaliningrad fishery firms had trained 200 Cuban students. In 1967, the Soviets hosted 3 FAO Fishery Seminars. One was held aboard a large research vessel and gave participants practical and theoretical experience.



United Kingdom

DEVELOPS ON-BOARD
GUTTING MACHINE

The White Fish Authority has developed a gutting machine for use on deck. It works well on cod, haddock, and whiting, cleanly gutting over 80% of the fish without damaging the fillet.

The machine is 44" x 30" x 36" high and weighs 860 lbs. and can be operated electrically or hydraulically. One worker can feed thirty to forty-five 10½-inch fish a minute. The throat is cut if the fish is to be frozen--but it is not if fish is to be landed fresh. The head is left on and the liver is removed with the guts. ("The Irish Skipper," Sept. 1968.)

* * *

NEW FISHERIES POLICY PROPOSED

The U. K. proposed a 5-year export plan for the deep-sea fishing industry with principal benefits going to companies making the most productive use of the resources.

The U. K. recognizes fluctuations in the industry's profitability and the need to preserve efficiency incentives. So a US\$4.8 million basic subsidy will be adjusted by reference to operating profits in the preceding year. If these are less than US\$9.6 million, the basic subsidy will be increased by half the difference; if more than \$9.6 million, the basic subsidy will be reduced by half the excess. The total annual subsidy, limited to US\$9.6 million, will not be allowed to rise above a profit-plus-subsidy level of \$16.8 million. Subsidy distribution will be related to a vessel's operating efficiency and not to its classification. ("Fisheries Council of Canada Bulletin.")

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GRANTS PRICE GUARANTEE
TO SHETLANDS

On Oct. 1, 1968, Shetland fishermen began to receive, for one year, higher minimum guaranteed prices for haddock, whiting, and cod. The Shetland Fishermen's Association members and buyers had agreed on prices¹.

New minimums (in U.S. measurements): haddock under 14 inches, 4.7¢ a lb.; over 14 inches, 5.8¢ a lb.; cod, unselected, 4.3¢ a lb.; whiting under 13 inches, 4.1¢ a lb., over 13 inches, 5.4¢ a lb. ("Fishing News," Sept. 27, 1968.)



LATIN AMERICA

Mexico

THE FISHERIES OF CAMPECHE

Campeche, the capital city of Campeche state, is one of Mexico's leading fishing ports. It is on the shores of the Bay of Campeche in the southeastern part of the Gulf of Mexico. It lies almost exactly halfway between the other two important fishing towns of the Yucatan Peninsula--Progreso to the northeast, and Ciudad del Carmen to the southwest.

Founded in the 16th Century, Campeche has experienced several economic booms. Over a long period, it was sacked at intervals by pirates. Its old fortifications, colonial churches, and nearby Mayan ruins have attracted some tourists. Agriculture still flourishes in the hinterland, but the city was slipping into deep slumber when development of a shrimp industry injected new life into the old town 20 years ago.

U.S. Demand for Shrimp

As the U.S. demand for frozen shrimp grew, adventuresome American and Mexican operators set up plants and brought boats to the sleepy seaport. Soon local families invested money they had made in hardwood, dyewood, chicle, and agriculture in freezing plants and trawlers. One family is said to own more than 50 shrimp boats. Campeche does not depend as heavily for its existence on shrimp as its neighbor, Ciudad del Carmen--but local people agree that Campeche would be hurt fatally if either the market or the resource disappeared.

Differs from Neighbors

As a fishing port, Campeche differs sharply from its neighbors. Progreso is strictly for fin fish; hook-and-line boats take groupers and snappers. Ciudad del Carmen is strictly a shrimp port. Shrimp is by far the most important species at Campeche, but there is a flourishing fishery for octopus, as well as beach seining for corbina (sea trout) and deep lining for groupers and snappers. Campeche boats fish regularly much farther from home than their neighbors. The name "Campeche" can be seen on the transoms of shrimp trawlers from Texas to Nicaragua. All the freezing plants pack fin fish as well as shrimp.

Campeche's Industry

The Campeche fishing industry is located along 5 miles of beach road between the city and the suburb of Lerma. Five freezing plants, a dozen boatyards, ship chandlers, ice plants, customs dock, fishermen's school, marine laboratory, oil dock, and tank farm combine to create a picturesque and efficient fishery complex.

Campeche's 5 operating freezing plants are, largest first: Booth Fisheries de Mexico, Congeladora del Golfo de Campeche, Congeladora y Empacadora de Mariscos de Campeche, Mariscos del Golfo, and Isla Camaronera. Booth is a subsidiary of a U.S. company. All other plants are owned locally or by residents of Mexico City. Booth is the pioneer plant and Congeladora y Empacadora the newest. The latter is a fine example of the latest in construction and equipment. Some plants have their own unloading docks; others use the customs pier and haul the shrimp to the plant by truck.

The combined rated capacity of the 5 freezing plants is 93,000 pounds of heads-off, shells-on, shrimp per day. Because most of the pack is peeled and deveined shrimp, which is a time-consuming process, actual operating capacity is probably not much over half this figure. A 6th plant is under construction on "Shrimp Row" for a group of local owners. It was scheduled to be placed in operation about the end of 1968 and would add considerable first-class production capacity to the industry.

A fleet of 170 to 200 shrimp trawlers serves the plants. The fleet is supplemented by a small but growing fleet of snapper (huachinangero) and grouper (merero) handline boats, and a host of canoes fishing for octopus and beach seining.

Shrimp Fleet

The shrimp fleet consists entirely of woodenhulled, "Gulf of Mexico" type double-rigged trawlers, most built in Campeche. Although manned by members of fishermen's cooperatives, in accordance with Mexican law, most are owned by private, usually local individuals. Nearly all the boats are powered by U.S.-built diesel engines (mostly Caterpillars). Recently, a West German engine

Mexico (Contd.):

manufacturer contracted to instal up to 50 German engines (MWM) by offering a "package" financing proposal. Under this, the purchaser of a new boat could borrow money not only for the engine but for the hull and all equipment. The offer was attractive, and 12 or 15 engines have been installed so far (plus 2 or 3 in Carmen). Some fishermen are pleased, others reportedly have been plagued by breakdowns and lack of parts. Most new boats continue to have U.S. engines installed. The trawl winches, patterned on popular U.S. models, are made by foundries in Merida and Campeche.

The fleet is being upgraded all the time. The vessels fish far from home and owners have learned that large, efficient trawlers

are essential. So, many smaller boats are being sold in Carmen, where trawling is in shallower water close to port, and are being replaced by larger craft. The local shipyards are kept busy on replacements and additions to the fleet. Each shipyard is no more than a space on the beach where 1 to 4 boats can be built at a time. On June 21, 1968, no fewer than 41 trawlers were in various stages of construction--from keel laying to outfitting. As each is finished, another is started. It requires about 6 months from keel laying until new trawler is ready to put to sea.

Offshore Fishing

The nearby waters are shallow and non-productive, so the trawlers fish offshore. The best grounds are around the keys--Cayos Arcas and Arrecifes Triangulos, and on the



The fishermen of Patzcuaro Lake, west of Mexico City, operating their unusual fishing gear. (FAO: Patrick Morin)

Mexico (Contd.):

flats a short distance inside these keys. Seasonally, some boats fish the newly developed banks in the Caribbean near Cabo Catoche and Isla Contoy. In all these areas, shrimp trips are 15 to 18 days. Local ice plants supply the vessels.

When fishing is poor around the keys, sometimes in May, June, and July, many Campeche shrimpers fish north of Tampico. They fish about 15 days after the 3-day run to the banks, and deliver the catches to Tampico freezing plants. Then they fish for another 15 days and return with the catches to Campeche. They deliver about half their production at each place. During the last year or so, a few Campeche trawlers have fished off Texas. Others fish for plants in Nicaragua during the local off season.

The Shrimps

Most of the catch is pink shrimp, often up to 90%. Because fishing is in fairly deep water, where larger shrimp are found, the pinks are larger than those taken by shallow-water fishermen at Carmen. A large proportion runs 15-20 to the pound (heads off) and some are under 15. The bulk of the production is peeled and deveined, then individually quick frozen (IQF). The plants are U.S.-made peeler-deveiners. The IQF shrimp are packed in 40-pound-capacity polyethylene bags and placed in cartons (also 40 pounds) for storage and shipment. The IQF are repackaged in the U.S.

The white shrimp and the largest pinks are packed heads off, shells on, in 5-pound boxes. Some plants pack only for export, others also ship to the domestic market, mostly to Mexico City. But some are sent to hotels in Merida and other cities. Most export shipments are made by refrigerated truck and trailer to Brownsville, Texas, a 72-hour trip. Some go by refrigerated ship to Brownsville and Miami. All freezers have sales arrangements with U.S. importers; most freezers sell exclusively to one buyer.

Fin Fish Fillets

Freezing and packaging of fin fish fillets for export are an important and growing part of the shrimp-plant business at Campeche. The principal product is sea trout fillets packed in 5-pound boxes. Groupers and

snappers are also processed. The favorite fish locally is the pompano (pampano). It is in good demand in Mexico City, and often appears on the menu at the higher-class seafood restaurants as "pampano de Campeche."

Octopus

Campeche is the site of a flourishing fishery for octopus, a popular seafood in Mexico, particularly in the capital. Most is purchased and shipped by truck to the Government's pilot fishing port at Alvarado, Veracruz, for packaging and freezing. Some is exported to Argentina.

Fishermen's Training School

The Department of Fisheries has recognized Campeche's importance as a fishing center. With the National Consultive Fishery Commission, it has established a Practical Fishermen's Training School and a Marine Biological Station on "Shrimp Row." The school teaches commercial fishing subjects. It operates a standard shrimp trawler with a regular crew, plus students. This vessel fishes exactly like a commercial trawler. It sells its catches to one of the freezing plants, so the students can learn the industry.

The marine station is staffed by 2 full-time biologists, several technicians, and support personnel. Advanced students work part time; visiting scientists, including some from the U.S., are often working on special projects.

U.S. Shrimpers

U.S. shrimp trawlers fishing on the Campeche Banks and around the keys often anchor off the city for a few days of rest during their long trips. About a dozen can nearly always be seen from the city, lashed together in groups as they transfer catches to vessels about to depart for home ports. When storms hit, the U.S. boats take shelter on the calm "flats" in even greater numbers.

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CATCH ROSE IN FIRST-HALF 1968

Mexico's fishery production rose during the first 6 months of 1968: to 125,448 metric tons, 14.6% above the 1967 period.

The catch of shrimp, the most valuable fishery product, and the sixth most valuable

Mexico (Contd.):

export, declined 9.4% from first-half 1967. Exports in Jan.-July were 296.6 metric tons, off 17.8% from 1967 period; exports for first-half 1967 were 33.6% over the 1966 period.

Fish meal production increased 7%, but was still far short of national needs. (U.S. Embassy, Mexico.)



Peru

THE ANCHOVETA FLEET

On July 21, 1968, 1,411 vessels were registered in the Peruvian anchoveta fleet. Processors own 71%, and independent operators 23%. About 60% are 5 years old; 1,178 were built between 1962 and 1966. Six hundred and forty-six are 65 to 69 ft. long; 821 are steel, 590 wood. Seventy-nine percent have power blocks, echo sounders, and fish pumps; engines average about 279 hp. Only 21% of the seine skiffs have engines. Fleet fish-carrying capacity is estimated at 180,406 tons; average vessel capacity is 128.

Callao and Chimbote lead in numbers registered, 363 and 349, respectively. ("Pesca," Sept. 1968.)

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FISHERMEN WIN BENEFITS

In late October 1968, the National Federation of Fishermen (FPP), 18,000 strong, was preparing for a strike when its leaders issued a postponement order. It followed an agreement with the Labor Ministry and industry officials.

Industry will provide medical benefits to fishermen and their families, and construct one or more medical clinics, probably in Chimbote or Callao. The only disagreement was over FPP refusal to accept a 10-sole (US\$,26) increase in the price paid fishermen per ton of anchovies over the present 102 soles (US\$2.60) granted by the Ministry a week earlier. FPP was asking a 68-sole (US\$1.74) increase. Final agreement was expected soon; the new rate should be approximately 115 soles (US\$2.95).

Uruguay

GRANTS TUNA CONCESSION TO ITALIAN FIRM

The state fishing monopoly (SOYP) has agreed to permit Finanzaria Brada S.P.A., an Italian firm, to conduct exploratory tuna fishing. The Italians, investing about US\$200,000, will send 1 or 2 vessels.

A final agreement will not be signed until the survey is completed in about 8 months. This agreement will require the Italians to form an Uruguayan corporation with 51% Italian capital and up to 49% public and private Uruguayan capital. SOYP will have priority in acquiring shares, and Uruguayan capital must be represented in the firm's directorate.

The Corporation Outline

The corporation will export the tuna as a Uruguayan product; Finanzaria Breda must provide the foreign market. Immediate goals are annual exports of 10,000 metric tons of tuna to Italy, and yearly export earnings of at least \$5 million. Finanzaria Breda will commit \$13 million--\$6,750,000 for fishing vessels and the rest for processing plants. The corporation must reinvest at least 50% of the profits in the Uruguayan fishing industry.

The vessels may fly the Italian flag but, after 5 years, the Uruguayan flag must be flown. Italian crews must be replaced by local crews within 5 years.

Opportunity for SOYP

SOYP has only 5 trawlers and small processing plant, and lacks the capital to exploit coastal waters. Fish has never been a popular food in Uruguay, and SOYP has had few opportunities to expand. The agreement makes it possible to earn money from nontraditional exports. Also, it offers the prospect of large investments in the small fishing industry. (U.S. Embassy, Montevideo.)



ASIA

Japan

INDUSTRY SUFFERS DECLINE

Since second-half 1967, a decline in the fishing industry has been apparent. Though the Tokyo Stock Exchange was active, maintaining a high Dow-Jones index of 1,500 yen, stocks of 4 out of 6 fishing companies were listed below face value.

Never before has the industry had the many domestic & foreign problems of the end-1967 through mid-1968 period. In December 1967, Britain suddenly devalued the pound by 14.3%. The U.S. intensified its defense of the dollar under pressure from Vietnam outlays. As a result, Japanese exports of frozen tuna, pearls, whale oil, and canned salmon have dropped. Exports of marine products will be less than US\$300 million in fiscal year 1968. Pelagic trawl-fishery operators have gone into debt because they are being eliminated gradually from rich areas by other countries extending their exclusive fishing zones or territorial waters. Rising costs are making it difficult to fish distant grounds. Quotas for Antarctic whaling, and North Pacific whaling, salmon, and crab continue to decline. The number of active shrimp ventures abroad is so small that maximum annual sales of only one billion yen (US\$2.8 million) cannot cover deficits in the salmon and trawl fisheries. Factoryship processing of frozen surimi (mince meat and meal) will contribute something, but companies are suffering rising costs for vessels, fishing equipment, and labor. Shore bases, too, have problems.

Suggestions for Government

The basic position of the Agriculture and Forestry Ministry toward fishing vessels of the large companies must be revised. The Ministry is using the same approval system as was used in the Tokugawa Era (feudal era) and has made few decisions. It was easy to adopt regulations for coastal fisheries because of pressure from the Diet. For example, construction of large fish reefs, which the Ministry has been sponsoring in recent years, will increase fish locally--but will not contribute much to Japan as a whole. Some say they might as well throw money into the sea as contribute to the manufacture of concrete blocks.

Distant-Water Fishing Problems

There is no guidance for pelagic trawl fisheries. They have lost their right to purse seine and trawl fish near Japan; they have been forced to fish in distant waters. Restrictions have been imposed that block distant-water operations. The fishing industry will be badly placed in the future, when compared with foreign vessels. The industry does not want complete freedom, but it does want the present approval system eased. The large companies contribute 50% of Japan's total fish supply, so the government should finance and administer it.

Japanese pelagic trawl and tuna fisheries must pay a fee to fish in Australia's and New Zealand's expanded fishing zones; a similar position may be taken by African and South American countries. The Japanese government could pay half of fee. ("Suisan Keizai.")

IMPORTERS FORM INSPECTION ASSOCIATION

The Fishery Products Importers Association, whose members imported 70% of all fishery imports in 1967, has established an Inspection Association to handle the growing volume of imported shrimp, fish roe, agar-agar, and other fishery products.

What It Will Do

The new organization will: (1) inspect and certify imported fishery products by Importers Association quality standards; (2) certify conformance with contracts; (3) travel abroad, when requested, to inspect and certify volume purchases; (4) sample entire shipment to assure uniform quality; and (5) perform inspection for nonmembers when possible. ("Suisancho Nippo," Oct. 4, 1968.)

TRADE MISSION RETURNS FROM ITALY

The government-industry fishery trade mission sent to study Italy's frozen-fish import situation has returned. The group found that Italy, the second biggest buyer of Japanese tuna after the U.S., requires 40,000-45,000

Japan (Contd.):

metric tons (MT) of raw tuna annually for the packing industry. Because Italy's domestic catch is only around 2,000 tons a year, packers depend heavily on imports. During Jan.-June 1968, Italy imported 17,000 tons of raw tuna; Japan supplied 75%. Imports during Jan.-Sept. were 26,000 tons.

Import Duties and Restrictions

Italy probably will not impose more import restrictions on Japanese tuna because the European Common Market may remove quantitative restrictions on fish imports from non member countries. At present, Italy admits up to 30,000 MT of frozen tuna duty free; imports from 30,000-45,000 tons are dutiable at the rate of 0.5%, and over 45,000 tons at 23.8%. A price standard of c.i.f. \$350 per MT for yellowfin tuna imports was established in July 1968. Yellowfin imported at lower prices is taxed to cover the difference. ("Nihon Suisan Shimbun," Nov. 1, 1968.)

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PROMOTES CARIBBEAN MARKET FOR MARINE ENGINES

To promote export of marine engines to Caribbean countries, the Japan Marine Engine Export Promotion Assoc. will send a team of experts to conduct market studies in January 1969. They will study the market structure, use of foreign equipment, and volume and value of marine engine trade. Since about 3,000 vessels, mostly powered with U.S.-made main engines, fish in the Caribbean, the Association believes there is market for Japanese engines.

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PLANS LARGER VESSELS FOR DISTANT WATERS

Owners of one-boat purse seiners presently operating off west Africa feel that larger vessels, like the U.S. seiners that fished there in summer and fall 1968, are essential for successful operations in distant waters. For example, 'Hakuryu Maru,' 500 GT, 250-ton carrying capacity, will be replaced by a 1,000-ton carrying capacity seiner to be built in 1969. The new seiner is likely to be sent first to the eastern Pacific for trials. Hakuryu Maru spent several months test fishing in the eastern Pacific before going to the Atlantic.

Year-Round Fishing Desired

Owners of 'Gempuku Maru,' another 500-GT seiner fishing off west Africa, are planning to replace her with a larger vessel. The Japanese would like to fish tuna year-round, alternating between the eastern Atlantic and eastern Pacific during the good yellowfin season.

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TUNA SEINERS IN SOUTH & EAST PACIFIC

Two one-boat purse seiners, 'Nissho Maru,' 253 gross tons (GT) and 'Taikei Maru No. 21,' 210 GT, were scheduled to depart Japan in November 1968 to fish tuna in the South Pacific north of New Guinea. Nissho Maru made money in the same area in 1967. She landed yellowfin and skipjack worth US\$36,111 on a 40-day trip. She had trouble with gear, transportation, and finding fish. In the 1968 trip, she was carrying a larger, improved seine, 1,143 fathoms long and 189 deep--about 100 fathoms longer and 10 deeper than the 1967 seine. The new net's sinking rate is much faster, around 18 m. (59 ft.) a minute, compared with 16.5 m. (54 ft.) for the previous one. A carrier vessel was accompanying the seiner to receive the catch. Visual methods still might have to be used to locate fish schools. Taikei Maru was alone.

4th Year of Experimental Seining

The 1968 trip was the fourth year of Japanese experimental purse seining in the South Pacific. In 1967, four seiners operated there. In 1968, two, 'Hayabusa Maru No. 3,' 280 GT, and 'Tokiuwa Maru No. 53' changed plans. The former was scheduled to go to the eastern Pacific off Central and South America where Japanese long-liners were fishing. The vessel's first experimental operation in the eastern Pacific will put her in competition with U.S. tuna seiners. This region is in the yellowfin regulatory area of the Inter-American Tropical Tuna Commission. Tokiuwa Maru No. 53 will operate off southern Taiwan, seeking mackerel and skipjack tuna. The owners applied for a Taiwanese fishing permit because that area was being explored by the Taiwan-chartered 'Haiho Maru No. 1,' 90 GT. ("Minato Shimbun," Oct. 31, 1968.)

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Japan (Contd.):

TUNA FLEETS FISH
SOUTH PACIFIC & ATLANTIC

In October 1968, more than 120 Japanese tuna long-liners were operating off Australia in the high latitudes of the South Pacific and Indian Oceans. About 90 were fishing bluefin between 100° E.-110° E., and 35° N.-40° S., off Fremantle, on Australia's west coast, landing 1.5 to 4 tons a day. About 30 vessels on Australia's southeastern coast, off Tasmania, were landing less than a ton a day each, though a few were taking over 1.5 tons.

In Atlantic

There were more than 60 vessels in the Atlantic. After the albacore fishery off Angola tapered off, they shifted to the more northerly albacore grounds and to the central Atlantic yellowfin grounds. The combined Taiwanese, South Korean, and Japanese fleet in the Atlantic exceeded 140 vessels. This was close to previous peak Japanese operations. ("Suisan Tsushin," Oct. 1, 1968.)

* * *

U.S. PACKERS REJECT
YELLOWFIN SHIPMENTS

In October 1968, U.S. west coast packers were rejecting more than 20-30% of Japanese frozen yellowfin shipments because of improper freezing and green or dark meat.

The shipments were mostly summer catches from the Indian Ocean, where good yellowfin catches had averaged as much as 5-7 tons per operating day. Fishing vessels there could not freeze all of the catch.

Many vessels were South Korean and Taiwanese. Some of their shipments, too, were being rejected. ("Suisan Tsushin," Oct. 1968.)

* * *

EXPORTS MORE CANNED MACKEREL

Canned Pacific mackerel exports increased to about 3.6 million cases in Jan.-Aug. 1968, up 800,000 from 1967. If the trend continues, 6.5 million cases will be exported in 1968, exceeding by far the 5.07 million in 1967.

The Philippines, the leading buyer, took about two-thirds. Shipments to South Vietnam, negligible in the past, rose suddenly because the Vietnamese government removed import restrictions on food. The principal variety exported to Vietnam was the No. 1 Small (5-oz. tall 100s) in tomato sauce, priced at c. & f. US\$6.60-6.70 a case. By the end of 1968, exports to Vietnam may reach 300-400,000 cases. ("Suisan Tsushin," Oct. 3, 1968.)

* * *

SAURY FISHING STEADY, PRICES UP

The saury catch, by Sept. 30, 1968, was 79,320 metric tons worth about US\$9.69 million. Compared with 1967, the catch was down about 10% in quantity but was up 28% in value. Average exvessel price was \$111 a short ton; it was \$77 in 1967. The increase was due to brisk demand for medium and large saury in the fresh-fish market, where virtually all the larger fish are sent. In the fishing ports of Sanriku, northeastern Honshu (the island on which Tokyo is located), large saury were bringing \$375 to \$958 a short ton, higher than the high-priced tuna. Normally, saury prices are high early in the season and drop sharply around September. Newspaper and television advertising and promotion held prices up in 1968.

Scarcity of Tuna Bait

Vigorous demand for saury in the fresh-fish market created a scarcity for tuna-bait dealers, volume buyers of medium-sized fish (11-13 fish per kg. or 2.2 lbs.). The tuna fishery's annual bait saury requirements are around 60,000 tons for domestic fishermen, and 20,000 for the South Koreans and Taiwanese. By mid-September 1967, bait dealers already had bought about half their supply; in 1968 they had purchased practically none. The tuna fishing industry was worried about a bait saury shortage and the resulting price increase. Bait saury were quoted at \$252-353 a short ton, exvessel, more than double the \$126 a ton in 1967. ("Suisan Tsushin," Sept. 28; Oct. 7, 1968.)

* * *

RAISE PRICES OF CANNED KING CRAB

After Nichiro Gyogyo's price increase for canned king crab meat in early July 1968,

Japan (Contd.):

Taiyo Gyogyo also raised its price, and Nihon Suisan was expected to follow. Increased demand, decreased production, limited quantity, and increased costs have raised export and domestic prices. The major export type of canned king crab (48 No. 2 cans, fancy/case) became US\$40.00 f.o.b.--up \$4 a case. Nichiro Gyogyo's domestic wholesale price for No. 2 cans has been raised 50 yen (14 U.S. cents) at retail. Nihon Suisan's new retail prices also increased 50 yen for No. 2 cans. As in the past, the margin is higher for domestic sales than for exports.

Lower Prices for Tanner Crab

Because of declining canned king crab production, leading fishing companies were expected to promote consumption of canned (zuwai-gani) tanner crabs by lowering wholesale and retail prices for tanner by 20 yen (6 cents) a can. Almost all canned hairy crab will be exported. ("Suisan Tsushin.")

* * *

SHRIMP IMPORTS & PRICES,
AUG.-SEPT, 1968

Frozen shrimp imports during August 1968 were 2,233 metric tons worth about US\$4,677,028, down 416 tons from July. Leading suppliers in August were Hong Kong, India, Mexico, Thailand, and Australia. ("Suisancho Nippo," Sept. 21, 1968.)

Sept. 1968 imports were 2,022 metric tons valued at approximately US\$4,113,900, lowest quantity in the past 23 months. The decline was attributed to the closure of the shrimp season in Mexico and other Central American countries, and the slowdown in mid-East shrimping. Japanese supplies were low in view of the approaching year-end and New Year holiday season when shrimp demand peaks. Mexico was the leading supplier with 329 tons, followed by Hong Kong with 261, Thailand with 236, and India with 222. ("Suisan Keizai Shimbun," Oct. 23, 1968.)

* * *

TUNA-IN-BRINE EXPORTS
TO U.S. STEADY

In mid-Sept., canned tuna-in-brine exports to the U.S. were continuing steady at about the

same pace as in normal years. By Sept. 14, 1,121,010 cases had been validated for export; 620,819 cases of large cans (55½-oz. 6's and 13-oz. 24's), and 500,191 cases of small cans (6½, 3½, and 7-oz. 48's). The large can pack is close to 35% of the 1.8-million-case annual export quota for that size. The total for the smaller sizes is nearly 42% of the 1.2-million-case annual quota. ("Suisan Tsushin," Sept. 20, 1968.)

* * *

CANNED TUNA-IN-BRINE
EXPORT PRICE INCREASED

On Sept. 24, 1968, the Tokyo Canned Tuna Sales Co. increased by 20-50 cents a case its price for canned tuna-in-brine exports to the U.S. The new prices affected all can sizes except the 66½-oz. 6's.

Trading firms anticipated the price hike and bought about 300,000 cases from the company the week before. The rash of speculative buying raised sales to a record 500,000 cases; it exhausted holdings of 7-oz. 48's and reduced sharply the stock of 13-oz. 24's. Movement of the 66½-oz. 6's was slow, and unsold stocks on Sept. 24 were about 380,000 cases of white meat and 160,000 cases of light meat. ("Nihon Suisan Shimbun," Sept. 30, 1968.)

May Buy Canned Tuna From U.S.

The price increase may force trading firms to buy U.S.-packed tuna. They claim that the 50-cent-per-case price hike on the 7-oz. 48's makes it more advantageous to buy the U.S. pack. If U.S. tuna packers do not raise their prices, more Japanese firms will start selling the U.S. product packed under their own brand labels. They did this once before when the Sales Company increased export prices. ("Suisan Tsushin," Oct. 3, 1968.)



Mauritius

TUNA PRICES STEADY

The October 1968 prices for tuna delivered to Port Louis, set by the Japanese Overseas Fisheries Co., at Penang, Malaysia, were: small yellowfin, US\$156 a short ton, an \$18

Mauritius (Contd.):

reduction; all other prices remained at July levels. Large and medium yellowfin were \$315; big-eyed and bluefin, \$202.

Since September 1968, albacore have been grouped into 3 size categories: large--over 33 lbs.; small--22-33 lbs.; extra small--under 22 lbs. Prices ranged from \$252 for extra small to \$371 for large.



Taiwan

AIDS INDONESIA

In September 1968, a 7-member Indonesian delegation went to Keelung, Taiwan's largest fishing port, to discuss plans for a Chinese firm to supply and crew 120 fishing vessels. The vessels, to operate in "3 areas inside Indonesia's territorial waters," will sell their catches in nearby Indonesian markets.

Indonesia claims an inland sea of 100 miles under archipelago doctrine, in addition to 12-mile territorial limits.



North Korea

BUYS FACTORYSHIPS
IN THE NETHERLANDS

'Keumgang San,' a factoryship built for North Korea at Verolme's shipyard in the Netherlands, launched on Oct. 12, 1968, will be completed by the end of Dec. 1968.

Keumgang San is equipped with a complete fish-meal plant, two holds for frozen fish blocks, and fish oil tanks. She has a total hold capacity of about 9,400 cubic meters, a carrying capacity of 7,050 dead-weight tons, accommodations for a crew of 256, and a 5,500-hp diesel engine.

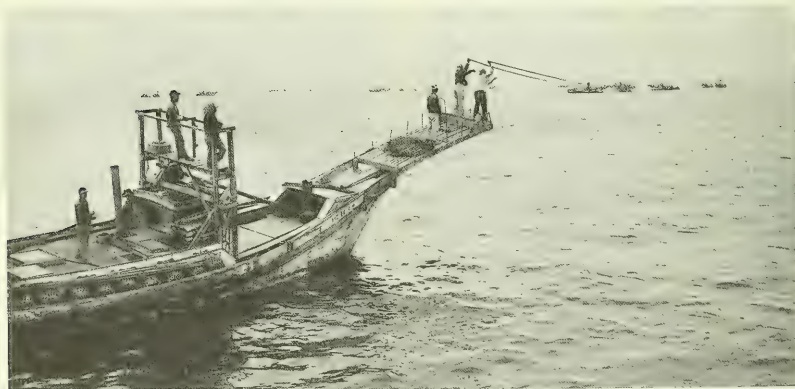
Immediately after the launching, a keel was laid for a sistership, also destined for North Korea.



Singapore

SUPPLIES SOVIETS

Singapore is an important supply port for Soviet fleets fishing in the Indian Ocean and whaling in the Antarctic. About 70 vessels were expected to obtain water, fuel, and other supplies in late 1968.



Along Taiwan's east coast, from October through March, small boats seek spearfish, sharks, and other large fish. The fish are harpooned from spearing platform.

(Commission on Rural Reconstruction)

SOUTH PACIFIC

American Samoa

SET TUNA PRICES

Japanese suppliers and U.S. packers in American Samoa agreed to a US\$5-per-ton price increase for albacore and yellowfin tuna deliveries in November 1968. The new prices were, per short ton: round albacore--frozen \$390, iced \$375; gilled-and-gutted yellowfin--frozen \$375.50, iced \$370.50. ("Suisan Keizai Shimbum," Nov. 1.)

Tuna Delivery Prices at American Samoa July-October 1968				
Species	Oct.	Sept.	Aug.	July
. (\$/Short Ton)				
<u>Albacore</u> (round):				
Frozen	385	382.50	380	377.50
Iced	370	367.50	365	362.50
<u>Yellowfin</u> (gilled & gutted):				
Frozen	322.50	320	317.50	317.50
Iced	302.50	300	297.50	297.50

Packers and suppliers had previously agreed to a US\$2.50-per-ton increase in September and a similar increase in October. The Japanese had pressed for a \$10 increase, while the U.S. packers wanted to maintain August prices. ("Suisan Tsushin," Sept. 11.)



Australia

PLASTIC FISH CRATES REPLACE WOOD

The New South Wales Fish Authority has banned the use of wooden fish crates in favor of plastic. The new crates are economical, hygienic, durable, and easy to handle and store.

Made of a special "crate grade" high-density polyethylene, the new crate ensures that fish arrives at market in first-class condition. It was designed to handle about 65 lbs. of fish, 25 to 30 lbs. of ice, and to be stacked at least 5 high when full. Empty crates nest neatly and gain valuable backloading space on the trucks returning them to the cooperatives. A method of outside draining was devised that diverts water down the outside of the crate. This eliminates possible ammoniation damage to the fish stacked below.

In New South Wales, the distance from point of catch to market ranges from 50 to 550 miles. Since the plastic rate was introduced, fish quality has improved appreciably. The fish are bringing a higher price per pound.

* * *

AIRLIFTING LIVE ABALONE TO JAPAN

Australia has been experimenting with airlifting live abalone from Tasmania to Japan for gourmets who like their shellfish fresh. The trial shipments, which began in July, were so successful that Australia may start commercial shipments within the next few months. ("Shin Suisan Shimbum," Sept. 16.)



POWER FROM WAVES

Harbor buoys have been developed and tested in Japan which utilize motion of waves to generate electricity for their lights and foghorns instead of standard or solar batteries. The buoys work on two principles: a turbine-type buoy generates electricity through the vertical movement caused by waves acting on a long stem attached to its bottom; and a pendulum type converts the rocking motion of the buoy into a horizontal force that generates electricity. They are reportedly less expensive to operate and less troublesome to service--requiring a battery check only once or twice a year and general repair every two years. (Reprinted, with permission from "Science News", weekly summary of current science, copyrighted 1966 by Science Service, Inc.)



Dahomean fishermen point their pirogue seaward. In Dahomey, fish is an important source of protein. In recent years, FAO has worked to put the fisheries on a modern course: to introduce up-to-date gear and equipment (out-board motors, nylon nets) and to improve structure and management of fishermen's coops. (UN Photo)

AFRICA

Senegal

THE FISHING INDUSTRY

Senegal claims territorial waters up to 12 nautical miles from shore and exercises fishing rights over 6 more. In 1967, her marine fishery yielded 132,985 metric tons of fish and shellfish worth \$18,300,000.

About 105,423 tons were landed by pirogues (canoes); 22,182 by sardine and tuna vessels; 4,236 by trawlers and cordiers (line vessels); and 1,174 by beach seines and cast nets. Sardine and sardinelike fish landings were around 45,000 tons; groupers, bluefish, sea bass, croaker, and horse mackerel exceeded 4,000 tons. Shrimp catch was 1,675 tons; oyster, shell on, slightly over 400. About 50% of the catch was sold fresh, 32% dried, 7% canned, and 10% was exported.

Shrimp Fishery

The most exciting developments are in the shrimp fishery. In 1967, half the catch came from trawlers and half from small-boat fishermen; 1968 sea production was expected to double, while river production should stay at the 1967 level.

River shrimp, primarily small and medium-size *Penaeus duorarum*, are caught during their seasonal migration to the sea. About three-fourths come from the Casamance River in southern Senegal, the rest from around Kaolack in the Sine-Saloum region. On the Casamance, pirogues anchored in the river fish with 2 small nets at right angles to the flow of water. The tops are kept slightly above or below the surface, depending on the amount of debris floating down river. After landing, the shrimp are trucked to Ziguinchor for processing. Peak season on the Casamance is May to August. In the Sine-Saloum fishery, shrimp are taken by drag seines in shallow estuarine areas.

The largest shrimp enterprise in Ziguinchor is Amerger-Casamance. One process used at the plant is brine-freezing of cooked whole shrimp; the management claims this adds 3% to the weight, compared to weight loss with other freezing methods. Shrimp are sent to Dakar and Europe by air or sea.

SOSECHAL also operates a shrimp-processing plant in Ziguinchor.

The most spectacular development is in offshore shrimp, *Penaeus duorarum*. In July 1968, predictions were that the 1968 catch would be 100% greater than in 1967. Around 25 Dakar-based old side trawlers fish shrimp. Early in 1968, about 20 of them were rigged for U.S.-style twin-trawling. Results have been outstanding.

There are 2 main fishing grounds--one on the continental shelf in the north, towards the Mauritanian border, and one in the south. Production is heaviest during November to August. SOSECHAL, SURGEL, SPAC-AMERGER, and CRUSTAVIF are among the more important companies involved.

Spanish and other foreign trawlers take deepwater shrimp, *P. longirontris*, on the continental slope.

In 1967, 849 metric tons were exported; preliminary data put the Jan.-June 1968 figure at 1,380. France is the most important market, Belgium is next, and Spain takes much of the large size. Whole cooked shrimp are the largest exports, but sizable quantities of fresh whole, tails, and peeled are sold. Both air and sea transport are used. Shrimp exports are taxed.

Tuna Fishery

The 1967 season catch was 9,392 metric tons--yellowfin, 7,522 tons, and skipjack, 1,870--landed by 43 French and 5 Senegalese vessels. The French fish out of Dakar from November to June; the Senegalese fish all year. During July-Oct., they fish as far south as the coasts of the Congo and Angola. The vessels are owned by the Societe Senegalaise d'Armement de Peche (SOSAP), a government unit. The first of 14 new tuna vessels ordered by SOSAP from French and Soviet yards was expected to arrive around the end of 1968.

Tuna landings were divided among local canners: SAPAL, 4,995 tons; Conserverie du Senegal, 2,672; and SCAF, 1,735. Some tuna, canned in oil or natural, is consumed locally, but most is exported to France under a special duty-free quota.

Senegal (Contd.):

SOSAP is building a large cannery in the port area. It will be operated by Pecheurs de France, owners of Conserverie du Senegal, and financed by Senegal. The plant has 15,000 square meters of floor space and 2,403 cubic meters of cold storage at -20° C. Initially, there will be 2 production lines with an annual capacity of 12 to 14,000 tons. Space is available for 2 more lines, which would bring capacity up to 30,000 tons. The plant will process tuna and sardines; other species will be added.

The main problems will be to secure an adequate supply of raw tuna and to find new markets. When the SOSAP plant is completed, processing capacity will exceed 35,000 metric tons of raw tuna annually; only 9,372 tons were landed in 1967. Officials are counting on the 14 new vessels to provide supplies. The French import quota is only 10,000 tons so markets will have to be found for the anticipated increase of 200%. Senegalese producers may be forced to enter the highly competitive U.S., Italian, and West German markets.

Sardine Fishery

The 4-vessel sardine fleet--3 Senegalese and 1 French--has increased production much more rapidly than planned. In 1967, 12,364 tons were landed; half was marketed fresh, 485 tons were canned, 2,821 frozen, and the rest used for fish meal. Oversupply might disturb the small-boat fishery because the Senegalese do not like to use fish suitable for human food as raw material for fish meal--the only outlet for any sudden large increase in landings.

Fish Meal

Afric-Azote, the only fish-meal producer in Senegal, is building a larger plant. It will be able to handle 120 tons of raw fish and waste per day. As the building permit emphasizes odor control, and the plant will use cannery waste and spoiled fish, the owner has devised a refrigerated holding tank to store them. Nearly all meat is exported to France and the Ivory Coast.

Trawler Fleet

In 1967, the trawler fleet produced 3,121 metric tons worth \$1,623,000. Most landings were shrimp, sea breams, sole, spiny lobster, and mullet. The catches brought good prices on the fresh-fish market in Dakar, but a large amount was processed for export.

Cordier Cooperatives

Cordiers are small line vessels built locally from FAO designs. They are 13 meters long, 6 to 8 tons, and powered by a 65-70 horsepower diesel engine. Vessel ownership is shared by the 10 fishermen who man the vessel. Twenty-five percent of each catch is sold to pay off the Senegalese Development Bank loan on the vessel. The cordiers are squeezed between high operating costs and low prices. Government officials are considering a large cooperative to overcome these problems. The success of any cooperative will hinge, in great part, on securing strong management, keeping overhead low, and educating the fishermen on their responsibilities--a formidable challenge under the best of circumstances.



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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

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UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE

BUREAU OF COMMERCIAL FISHERIES



Holiday Greetings



From The
Bureau of Commercial Fisheries

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Fishes

COMMERCIAL FISHERIES *Review*

INDEX FOR 1968 VOL. 30



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An index of Volume 30, Numbers 1 through 12, issued in 1968. It is a subject index, with an author index for only the feature articles in each monthly issue. Indexing of other material is based on the principal subject with some cross-reference. The use of "_____" in entries denotes the omission (repetition) of the major subject heading which appears in ALL CAPS.

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Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

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A limited number of back issues of Volume 30, Numbers 1 through 12, are still available until the supply is exhausted. Copies are available free upon request from Commercial Fisheries Review, U.S. Bureau of Commercial Fisheries, 1801 N. Moore St., Rm. 200, Arlington, Virginia 22209.

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- "North Pacific Fisheries Symposium," new book on North Pacific fisheries treaties; Mar. p. 56.
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- "Project Headstart Food Buying Guide and Recipes," 120-page booklet published by OEO, useful information for low-income groups; Feb. p. 22.
- "Questions About The Oceans," new book answers 100; June p. 15.
- "Report on the Guinean Trawling Survey," joint project of STRC/OAU and A.I.D.; June p. 78.
- "Safety Notes for the Alaskan Fisherman," Coast Guard and BCF write safety booklet for fishermen; May p. 19.
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- "Suitability of the Susquehanna River for Restoration of Shad;" Oct. p. 4.
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Documentary on "Fishermen of Tacoma" planned; June p. 67.

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"Rorqual" studies distribution; Dec. p. 42.



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As a discriminating, thoughtful homemaker, you want the best for your family. When shopping for a particularly pleasing and nourishing entree--why not choose halibut steaks? Make sure that it is the true North Pacific halibut.



North Pacific halibut is an excellent source of high quality protein and minerals. Dieters like its low sodium, low fat, and low calorie content. Its firm, tender flesh is mild in flavor and wonderful for introducing seafoods to young people; it is readily accepted by older people as well.

Crun-Cheese Halibut is an easy answer for the "something different" that is just right for any occasion, because this recipe can add dash to weekday dinners or be a seafood sophisticate that is elegant enough for a party. North Pacific halibut steaks are marinated in a tangy French dressing-lemon juice mixture, then baked to succulent just-right perfection under a blanket of French fried onion crunched with Parmesan cheese. Crun-Cheese Halibut has so much appetite appeal, you'll want to serve it often.

Crun-Cheese Halibut

2 pounds North Pacific halibut steaks, fresh or frozen	1 can (3½ ounces) French fried onions crushed
½ cup French dressing	
2 tablespoons lemon juice	¼ cup grated Parmesan cheese
¼ teaspoon salt	

Thaw frozen steaks. Cut steaks into 6 portions. Place fish in a single layer in a shallow baking dish. Combine dressing, lemon juice, and salt. Pour sauce over fish and let stand for 30 minutes, turning once. Remove fish from sauce. Place fish in a single layer in a well-greased baking dish, 12 x 8 x 2 inches. Combine onion and cheese. Sprinkle over fish. Bake in a moderate oven, 350° F., for 20 to 25 minutes or until fish flakes easily when tested with a fork. Makes 6 servings. (Source: Interior Department's BCF.)

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.



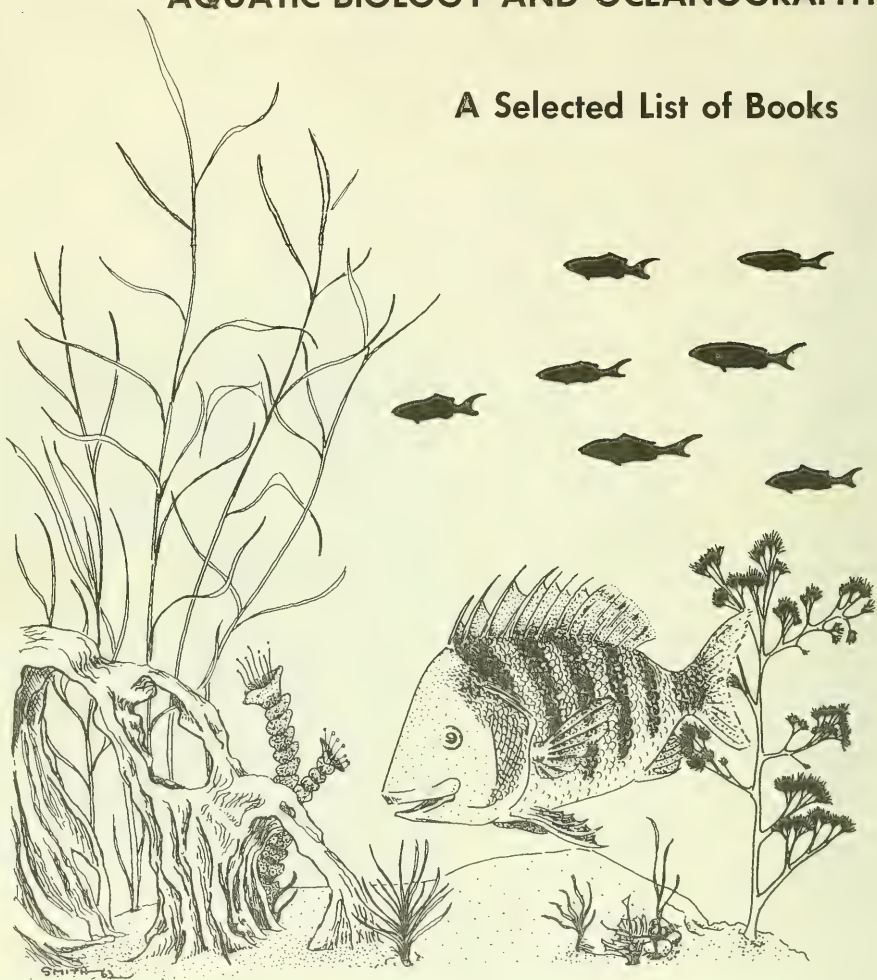
UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES



AQUATIC BIOLOGY AND OCEANOGRAPHY

A Selected List of Books



Fishery Leaflet 541, published in January 1963, was prepared to furnish information sources to students and others who are interested in fishery science, aquatic biology, and oceanography. The references range from general works to books with which the reader may identify species of mollusks, fish, invertebrates, or aquatic plants. Those who wish to read further on special topics will find additional references included in many of the books on the list. (This leaflet is available free from Division of Publications, BCF, 1801 N. Moore St., Arlington, Virginia 22209.)





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