



Massachusetts Fisherman.
(Standard Oil of N. J.)

1967 U. S. SHRIMP LANDINGS SET RECORD

The shrimp was the most valuable species to U. S. fishermen in 1967. Landings of 313 million pounds (heads on) were worth \$102 million--a record quantity and value. The previous high catch was 268 million pounds in 1954.

Shrimp is the first marine fishery resource to attain a value of more than \$100 million to domestic fishermen.

The 1967 landings were up 80 million pounds and more than \$6 million over 1966.

All shrimp-producing areas, except the South Atlantic, registered gains.

Maine, Alaska, and Oregon achieved much greater percentage increases in landings than other areas; records were set in the three States.

The Southern States contributed 79 percent to the total--down from 84 percent in 1966.

GULF OF MEXICO

Landings at Gulf of Mexico ports rose 45 million pounds. This increase was produced by a record supply of the brown species in the northern Gulf off Louisiana and Texas. Landings were heavy during the summer, the peak of the brown shrimp season. Nearly half the 1967 Gulf shrimp catch was landed during June, July, and August. During 1957-66, only 35 percent was landed during these 3 months.

In September, Hurricane Beulah paralyzed fishing and damaged many vessels (some were destroyed) and shore establishments. Major damage centered in the area of Pt. Isabel-Brownsville, Texas, an important shrimp production center, but a wider area was affected. (BCF Branch of Fishery Statistics.)

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UNITED STATES

Set 1968 Tariff Rates for Groundfish Fillet Imports

The reduced-tariff-rate import quota on fresh and frozen groundfish (cod, haddock, hake, pollock, cusk, and ocean perch) fillets and steaks for 1968 is 24,894,900 pounds. This was announced by the Bureau of Customs in the Feb. 7, 1968, "Federal Register."

During each quarter of 1968, 6,223,725 pounds of groundfish fillets and steaks may be imported at the $1\frac{7}{8}$ cents-per-pound rate of duty; imports over the quarterly quota will be dutiable at the rate of $2\frac{1}{2}$ cents a pound.

Quantity Increased 25% in 1951-1960

The reduced-rate import quota for 1968 changed only slightly from the 1967 quota of 24,883,313 pounds. From 1951 to 1960, the quantity of fresh and frozen groundfish fillets permitted to enter the U. S. at reduced duty rate of $1\frac{7}{8}$ cents a pound had increased 24.7 percent. In 1961, however, the trend was reversed significantly for the first time. It occurred because in 1960 frozen fish fillet blocks with bits and pieces had become no longer dutiable under tariff category "frozen groundfish fillets."

Kennedy Round Concessions

U. S. concessions granted in the 1964-67 Geneva trade conference (Kennedy Round) reduced the duty rate on fish blocks (with bits and pieces) from 1 cent a pound to 0.8 cent a pound on Jan. 1, 1968.

Concessions on fish blocks are being put into effect in 5 equal annual stages. The final reduction will become effective Jan. 1, 1972. Then fish blocks will be duty free.



1967 U. S. Salmon Landings Were Way Down

Preliminary records indicate the 1967 U. S. catch of salmon of 204 million pounds was down 184 million from 1966. It was 96

million less than the annual average during 1957-66. A big drop in Alaska landings was offset partially by a significant increase in Washington and Oregon. During 1967, landings in Washington, Oregon, and California were 73 million pounds, an increase of nearly 19 million from 1966--and nearly 22 million pounds above the average yearly catch during 1957-66.

The 1967 Alaska salmon catch was a failure: landings of 131 million pounds were the lowest since 1899. The catch was 61 percent less than 1966, and 47 percent lower than the average for 1957-66. Yearly records of total catch are available since 1865, but a listing by species was first recorded in 1906. Over the years, the pink species has dominated the Alaska salmon catch. It was followed closely by red (sockeye). Both species made up $\frac{3}{4}$ percent of the total salmon catch. For the 61-year period, 1906-66, Alaska salmon landings were: pink 43%, red (sockeye) 33%, chum (keta) 16%, silver (coho) 5% and chinook (king) 4%.

Pink Salmon At Record Low

The 1967 Alaska catch of pink salmon was 27 million pounds--a record low. It was only one-fourth the average yearly landings during 1957-66. The previous low catch of pink salmon was close to 31 million pounds in 1906, the first year data were collected. Pink salmon landings of less than 50 million pounds occurred in 1906-07, 1909-10, 1920, and 1959. Alaska's 1967 landings of red (sockeye) salmon of 52 million pounds were 18% lower than 1957-66 average. The previous low catch was nearly 36 million pounds in 1963. Red salmon landings of less than 50 million pounds occurred in only 4 years--all since 1954. The 1967 catch of chum (keta) was 29 million pounds, the same as in 1965. It was 40% less than the previous 10-year average. Silver (coho) landings were 12 million pounds, 4 and 2 million less than 1966 and the 1957-66 average, respectively. The previous low silver catch was in 1960--10 million pounds. Landings of king (chinook) in Alaska during 1967 were 10 million pounds--one million above 1966 but about the average annual quantity during 1957-66. (BCF Branch of Fishery Statistics.)



1967 U. S. Fish Meal, Oil, and Solubles Production Declined

According to BCF, U. S. production of fish meal, oil, and solubles during Jan.-Dec. 1967 and 1966 was:

	Jan. -Dec.	
	1/1967	1966
	.. (Short Tons) ..	
Fish Meal and Scrap:		
Alewives	4,508	3,746
Groundfish	7,909	6,311
Herring	9,273	11,850
Menhaden ^{2/}	119,125	134,954
Tuna & mackerel ^{3/}	32,447	29,758
Unclassified	12,157	24,728
Total fish meal & scrap	185,419	211,347
Shellfish meal & scrap	4/	11,773
Grand total meal & scrap	4/	223,120
Fish Solubles:		
Menhaden	51,536	60,769
Unclassified	22,155	22,672
Total solubles	73,691	83,441
	.. (1,000 Lbs.) ..	
Oil, body:		
Alewives	1,827	5/
Groundfish	1,348	536
Herring	5,078	7,862
Menhaden ^{2/}	98,449	144,198
Tuna & mackerel ^{3/}	6,210	4,884
Unclassified (inc. whale)	6,711	6,565
Total oil	119,623	164,045
1/Preliminary data.		
2/Includes a small quantity of other species.		
3/Includes anchovies.		
4/Not available on a current monthly basis.		
5/Included with unclassified.		

U. S. Foreign Trade

The Bureau of the Census reported the following U. S. foreign trade in selected industrial products for Jan.-Dec. 1967 and 1966:

	Jan. -Dec.	
	1/1967	1966
	.. (Short Tons) ..	
Imports:		
Fish meal & scrap	651,486	447,784
Fish solubles	3,669	4,308
	.. (1,000 Lbs.) ..	
Whale oil, sperm (crude & refined)	51,318	58,166
Exports:		
Fish & fish-liver oils	76,816	77,254
Whale & sperm oil	1,787	4,356
1/Preliminary data.		



U. S. Fish Meal Prices Strongly Affected by Peru's 'Sole' Devaluation

The 32% devaluation of Peru's "sole" in September 1967 affected U. S. fish meal prices much more than did Peru's fisheries promotion law of Oct. 6, 1967. This was reported by BCF's Branch of Current Economic Analysis.

The promotion law reduced or eliminated export taxes by about \$7 per ton of fish meal. The devaluation reduced the cost of fish meal by about \$41 per ton. Together, these gave Peruvian producers about a \$48 advantage.

U. S. prices of Peruvian fish meal have dropped about \$12 per ton since Oct. 1, 1967. This would mean that Peru's industry is using about three-quarters of the cost reduction to improve its financial situation.



Georges Bank Survey Shows More Cod, Fewer Haddock

The preliminary results of a BCF groundfish survey in the Georges Bank area show somewhat more cod and fewer haddock than usual. The survey provided an estimate of the strength of the 1967-year class of haddock. Almost none was found. This indicates 1967 is one of the weakest year-classes ever measured.

It is bad news for the New England haddock fishery because it is the fourth consecutive poor year-class. Since 1963, which produced the record year-class, there has been poor survival of spawn. The 1963 year-class was overfished by the U. S. and foreign countries in 1965 and 1966 and so cannot maintain the yields of the past 2 years.

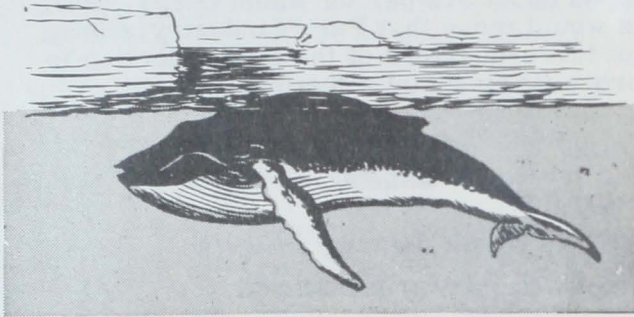
Haddock landings will continue to decline for at least 2 more years.



New World Whaling Rules to Bring U. S. Changes

Following recent changes in regulations by the International Whaling Commission (IWC), the U. S. Department of the Interior has proposed to amend U. S. rules to make them conform to the IWC's. ("The Federal Register," Feb. 9, 1968). Only one U. S. firm catches whales.

The proposed change will prohibit commercial whaling for North Atlantic blue whales before 1970 and humpback whales before 1969. There is an exception to the latter: small vessels in Greenland waters may take 10 humpbacks.



Humpback whale.

In the North Pacific and dependent waters, neither blue nor humpback may be taken before 1971.

Whaling Convention & Commission

The International Convention for the Regulation of Whaling has been signed by 16 nations, which are all represented on the Whaling Commission. The Commission meets every year to determine the status of whale resources. From time to time, it amends regulations to protect and conserve these resources.

At present, 4 species have nearly complete protection from commercial operations: right, blue, gray, and humpback. For other species, there are controls on seasons when they may be harvested and on sizes of whales.



U. S. and 4 States Plan Lake Michigan Cleanup

Officials of Interior Department's Federal Water Pollution Control Administration (FWPCA) and 4 states bordering Lake Michigan--Michigan, Illinois, Wisconsin, and Indiana--are meeting in Chicago, Ill., in March to draft a plan to clean up the lake.

Murray Stein, chief enforcement officer for FWPCA, presided at a February meeting of these officials in Chicago. He reported substantial agreement on pollution causes and on what the U. S. and the states have to do. He made clear that an adequate program would cost industry and local, state, and Federal Governments hundred of millions of dollars. But the alternative, he said, was a fate for Lake Michigan similar to that of Lake Erie, which is now almost beyond help.

Pollution Sources

The conferees agreed in February that the major pollution sources included inadequately treated municipal and industrial wastes--and combination sanitary and storm sewers. They listed too: dumping of polluted harbor dredgings, waste from water craft and chemical nutrients, such as nitrogen and phosphates. These chemicals cause algae and other undesirable forms to grow.

Remedies Proposed

There was general agreement that at least 90 percent of the impurities must be removed from municipal and industrial wastes. Also, waste water must be rid of phosphates before reaching the lake. And uniform testing and sampling of water quality must be established.

The conferees are confronted by the problem of obtaining the money they need. They also must agree on deadlines for ending certain types of pollution.

Udall Promises Support

The February conference was called by Interior Secretary Stewart L. Udall. He urged development of a program to save Lake Michigan from an "ugly, useless death." He promised to support fully the ultimate recommendations.



Promote Halibut to Overcome Depressed Market

The Halibut Association of North America is planning a national promotion campaign to aid the halibut industry. North Pacific halibut prices have declined despite a 1967 production of 7.4 million pounds below previous years. Competition from imports is a large part of the problem--particularly from Greenland halibut fillets.

The Association will emphasize 10 major markets: New York, Boston, Philadelphia, Chicago, Los Angeles, San Francisco, Washington, D. C., Baltimore, Minneapolis, and Pittsburgh.

BCF Will Help

BCF will assist in the promotion campaign by asking the U. S. Department of Agriculture to include halibut steaks on its Plentiful Foods List for April. It will try to get radio and TV public-service time to supplement paid advertising by industry. And BCF will encourage retailers to emphasize sales of domestic halibut steaks.



New Loran Stations in Gulf of Mexico

Two new loran stations--one near Brownsville, Texas, the other near Biloxi, Miss.--will enable U. S. fishermen to plot their positions from the stations to within $\frac{1}{2}$ mile at 800 miles and $1\frac{1}{2}$ miles at 1,400 miles. They will know their distance from the Mexican coast. The stations also will help Mexican enforcement of fishing limits and territorial waters.

Receiving sets for vessels cost US\$120. The Mexican authorities probably will buy sets for their enforcement vessels. The U. S. and Mexico have agreed on frequencies to use and the U. S. Coast Guard is poised to operate the stations.



Study Effects of Warmed Columbia River on Living Things

The Department of the Interior has announced a 2-year study on the biological effects

of sending heated water back into the Columbia River. The \$600,000 project is the first study of all aspects of thermal effects on the aquatic environment. The study will be conducted by Interior's Federal Water Pollution Control Administration (FWPCA).

The investigation was prompted by inconsistencies in the water-quality standards of Washington State and neighboring Oregon on temperature changes to be allowed in the Columbia. The study's chief aim is to provide a scientific basis for determining permissible variations in stream temperatures above natural levels.

What Study Involves

The investigation will use information from a mathematical model now being developed to forecast temperature changes in the Columbia resulting from varying heat inputs. The study will enlarge the mathematical model to include the entire river from Canada to the Columbia's mouth at Astoria, Oregon.

A first major step will be to determine the relationship between nitrogen levels and temperature and this combination's effects on anadromous and resident fish. BCF laboratory evidence indicates that the combination of excessive amounts of nitrogen gas and temperature changes can cause fish kills akin to divers' "bends." As water passes through dam spillways, it tends to pick up nitrogen gas from the atmosphere. There are other causes of nitrogen supersaturation; an important one is increases in water temperature.

Cooperative Undertaking

BCF will join FWPCA in the study. A scientific and technical advisory committee on heat effects on flora and fauna will be appointed by Interior Department to assist. Invitations will be sent to Washington, Oregon, Idaho, and Montana; the Atomic Energy Commission, the Bureau of Sport Fisheries and Wildlife, the Corps of Engineers, the Bonneville Power Administration, and the Bureau of Reclamation. The present task force on mathematical model studies will carry on.

"The results of this study are certain to have a major bearing on the whole unsettled question of thermal effects," Interior Secretary Udall said.



Lake Erie Commercial Catch Was Down in 1967

The 1967 commercial catch in Lake Erie was about 48 million pounds, down 6 million pounds from 1966. There were smaller catches in Canadian waters and in the 4 State areas. The 1967 figure was about average for the past 50 years.

There is real concern about further decline of fishing in U. S. waters. During the past few years, several fish companies have gone out of business. Nets and equipment are being advertised for sale, but there are few takers. Most fishermen are discouraged by the outlook. Fishing along Lake Erie's south shore has become a minor business. Little is being done by industry or administrative agencies to reverse this trend.

Commercial fishing in Lake Erie has become primarily a Canadian operation.



President Asks for Fish Inspection Act

On February 6, President Johnson asked Congress to legislate inspection of fish and fishery products. It was one of eight items in his fourth Message on the American Consumer.

The part of the President's message to Congress dealing with fish said:

"Wholesome Fish"

"If poultry inspection is spotty today, fish inspection is virtually non-existent.

"Each year, Americans consume about two billion pounds of fish--nearly 11 pounds per person. A common item in every family's diet, fish can also be an all-too common carrier of disease if improperly processed and shipped.

"Last summer, the Senate Sub-committee on Consumer Affairs heard testimony which disclosed that a substantial amount of the fish sold in this country exposes the consumer to unknown and unnecessary dangers to his health.

"It is impossible to show every link between contaminated fish and illness. Yet these links do exist: links to botulism, hepatitis, and other diseases. About 400 cases of food poisoning, reported on a single weekend in 1966, were traced to fish processed in dirty plants.

"Despite these facts, the Nation has no adequate program for continuous fish inspection--either at the Federal or State level. Nor is there any systematic program for inspecting imported fish and fish products, which account for more than 50 percent of our annual consumption.

"I propose the Wholesome Fish and Fishery Products Act of 1968.

"The bill would authorize the Secretary of Health, Education, and Welfare to:

-- Develop a comprehensive Federal program for consumer protection against the health hazards and mislabeling of fish, shellfish and seafood products.

-- Set standards and develop continuous inspection and enforcement.

-- Support research, training, and inspection programs.

-- Help the states develop their own fish inspection programs.

-- Assure that imported fish products are wholesome."

BCF Would Help Industry

Shortly after the President's message, the U. S. Department of the Interior sent to the Senate and the House of Representatives a draft of proposed legislation "to provide technical and financial assistance to the commercial fishing industry in meeting the requirements of the Wholesome Fish and Fishery Products Act of 1968."



OCEANOGRAPHY

Seismic Survey Planned for East Coast

Interior Department's Geological Survey plans to permit the Continental Oil Company (CONOCO) to conduct a geophysical seismic survey of the Outer Continental Shelf--from Florida waters through the Georges Bank area. The permit will be effective from March 2 until October 1.

The company will use the nonexplosive vibroseis seismic device. It will share information gained from the survey with 14 other oil companies. BCF has advised the fishing industry.

CONOCO is required to keep BCF Regional Directors informed weekly of its operating schedule. When it reaches Georges Bank, it will notify BCF by phone of any schedule changes between weekly reports.

CONOCO has invited BCF and any other interested groups to observe the shooting operations.



Scripps Vessel Begins Bering Sea Research

A research expedition to study how arctic fishes and mammals survive their frozen habitat--and why spawning salmon suffer from a degenerative disease of the arteries--is under way in the Bering Sea. From early March through late September, the 133-foot, 300-ton "Alpha Helix" of the Scripps Institution of Oceanography will be base and laboratory for 50 scientists from 5 nations. BCF is one of 25 participating organizations. The research program is being financed by \$574,000 in grants from the National Science Foundation.

Principal investigator for the expedition is Dr. Per F. Scholander, professor of physiology at Scripps and director of its physiological research laboratory.

What They Seek

One reason for the expedition, Dr. Scholander said, is to determine how practical it is to conduct scientific biological and physiological research in that area using the shelter of floating ice to obtain a steady laboratory. Also: "We want to know more about the defense mechanism that fishes have against the interior freezing of their bodies. They have some sort of an inbred anti-freeze, probably combined with some unknown physical mechanism. In arctic marine mammals, the flukes are ice-cold but the rest of their body is warm. How can they conserve body heat under such conditions? . . . We'll study the respiratory efficiency of gills and microcirculation of fishes living in this frigid environment. We hope to learn how the tissues of a reindeer's antlers grow under such cold conditions. Why are we and Eskimos so sensitive to snowblindness, when arctic mammals and birds are not?"

Salmon Research

The salmon studies will be conducted at Bella Coola, British Columbia. Dr. Andrew A. Benson of Scripps, senior scientist for the salmon research, commented that as the spawning salmon swims from the ocean into and up fresh-water streams, the walls of the arteries leading to the heart muscle become thicker. This reduces circulation to the heart and starves it of oxygen.

"The same situation occurs in human beings suffering from atherosclerosis," he said. "We will study the biochemical and physiological situations in the salmon that are analagous to those in human beings. At this point, no one knows why the walls thicken. We hope our study will help provide some answers." Salmon from the ocean and from fresh water will be studied.

Several scientists in Benson's party have conducted extensive studies with human patients having atherosclerosis, and they will be seeking similar conditions in salmon.

Spawning Salmon Under Stress

In the spawning situation, the salmon is under stress, Dr. Benson explained. There

is a relationship between stress and atherosclerosis, so the salmon will be studied for biochemical and physiological changes that occur under stress. There is some indication that similar changes occur in human beings. Dr. Benson said that stress involves the liberation of fats, such as phospholipids and cholesterol, into the blood. There they circulate and settle in various places--such as the fatty plaques that accumulate on aorta walls in people.

"As far as we know, a salmon doesn't develop this problem," Dr. Benson said. "In the salmon, the cholesterol is kept in solution in the blood and not allowed to attach itself to arterial walls. Our studies will include analysis of the lipid content in the blood for indications of how this condition might differ in the salmon."



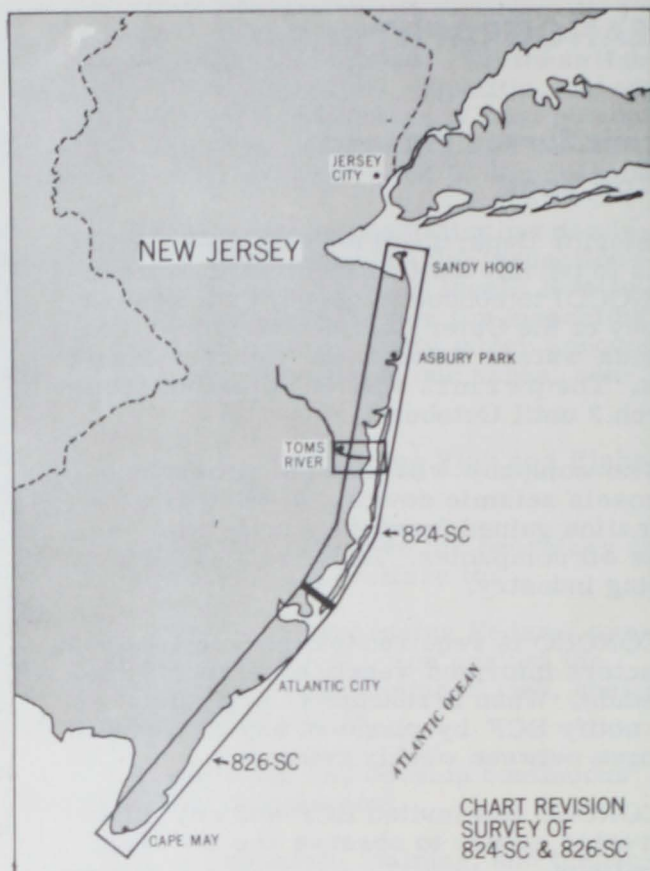
LASER Beam Can Aid Hurricane Forecasting

The ocean surface can be profiled from the air with a new method being tested by the U. S. Naval Oceanographic Office (NOO), Suitland, Maryland. NOO scientists are using a recently developed helium neon laser system to analyze ocean waves that are too small or too fast to be measured by usual methods. Development of the new method makes possible observational programs that can provide a basis for accurate forecasts of hurricane wave conditions.



Survey Fixes Navigational Hazards Along N. J. Coast

A hydrographic survey by the Coast and Geodetic Survey of the New Jersey coast from Sandy Hook to Cape May has pinpointed the presence of many sunken wrecks, piles, and other navigational obstructions. It disclosed a sunken wooden barge not visible on the surface but close enough to endanger boats passing over it--on the south side of the channel between Barnegat Inlet and Bay. It also verified or disproved many charted wrecks. A spokesman explained that some have washed or rotted away or were removed over the years.



The survey could not find, or found submerged, many piles--such as poles used to anchor boats, or as a foundation for fishing huts, or as private navigation markers. Many existing piers were found in ruins, including the seaward end of a 650-yard pier at Atlantic Highlands. The Coast Survey termed the piers a hazard to small boats.

Depths of Waterways Determined

Accurate depths were determined in the following waterways: Meteconk, Manasquan, Shark and Navesink rivers; Blackberry, Parker, Town, Little River and Troutmans creeks; and smaller waterways in the area.

Many new landmarks found will provide valuable aids to mariners navigating the New Jersey inland waterways. Existing landmarks also were evaluated from the sea to determine their value to marine navigation. Part of Toms River was included in the survey.

The results have been incorporated in new editions of Coast Survey charts 824-SC and 826-SC issued in February 1968.



First Hydrographic Survey in 40 Years Begins in South Puerto Rican Waters

ESSA's Coast and Geodetic Survey began in February a long-range program to survey the entire south coast of Puerto Rico and its offshore waters. It is the first in 40 years. The "Whiting," a 760-ton, 162-foot vessel, is conducting a 3-month hydrographic survey of the 225-square-mile coastal and offshore area between Cabo Rojo and Punta Jorobado.

The Survey's results will be incorporated into new nautical charts planned by the Coast Survey. The charts will benefit commercial shipping, recreational boating, sport and commercial fishing, and ocean research. They will help Coast Guard locate and establish aids to navigation along Puerto Rico's south coast.

Preparations for Survey

In preparation for the hydrographic surveys, color aerial photos were taken in February 1967. From these, shoreline and along-shore features were mapped. The photos and maps will be used to locate signals which will position accurately the survey launches, and to identify underwater dangers.



South Pacific Is Deeper, More Mountainous Than Thought

The bottom of the South Pacific, barely explored until recently, has many more undersea mountains and plateaus than previously reported, discloses the Environmental Science Services Administration (ESSA) of the U. S. Department of Commerce. Many parts of the South Pacific, deeper than formerly thought, are marked with unusual, still-unexplained features. These include giant fractures of the ocean floor that extend in a north-south direction, rather than east-west, as such splits do in the North Pacific bottom.

"Oceanographer's" Work

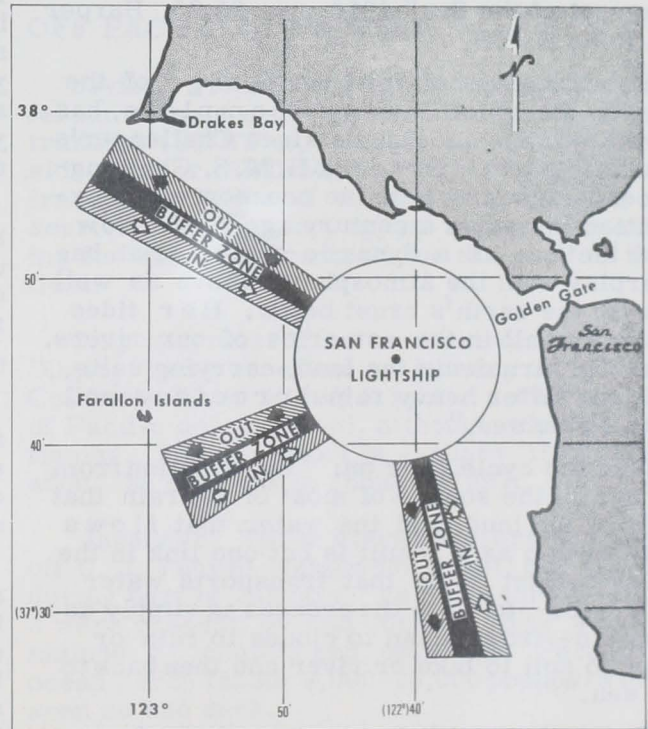
The discoveries are based on data gathered by ESSA's oceanographic survey ship Oceanographer during its global cruise. The data are being processed and studied by scientists in the U. S. and abroad. The task will take years.

The ship's electronic equipment obtained a continuous profile of the bottom. The equipment includes sonar and geophysical devices that plumb the bottom and the rock beneath it. Satellite navigation, with precise depth soundings from a narrow-beam echo sounder, provided a very high degree of accuracy.



Coast Guard to Set Up 'Divided Highway' for San Francisco Waters

The Coast Guard has approved a Sea Lanes system for San Francisco designed to reduce the chance of ship collision in the approaches to San Francisco Bay. It will start in June. The San Francisco plan is similar to those in New York and the Delaware Bay. The Sea Lanes are two one-way lanes separated by a "buffer zone"—much like a divided highway for road traffic.



The Coast Guard is encouraging foreign and domestic steamship lines to use these new, voluntary, safety lanes.

A circle with a radius of 6 miles will be established around the San Francisco Lightship at the Bay's entrance. The new Sea Lanes will fan out from the circumference.

The Coast Guard believes that use of the new safety lanes will reduce the number of head-on-meetings and close-passing situations generally known to create the greatest danger of collision. The basic chart of the area (Coast and Geodetic Survey Chart #5072) will be reprinted in June and include these new Sea Lanes.



New Book Portrays Oceans' Promises and Challenges

Man has relatively little knowledge of the oceans, but this mystery may not continue for long, suggests Dr. John E. Bardach of the University of Michigan in his new book: "Harvest of the Sea" (316 pp., \$6.95, Harper and Row, N. Y.).



Bardach says: "Our knowledge of the oceans, though still very incomplete, has grown by leaps and bounds since Challenger's return to port. [Britain's H. M. S. Challenger conducted first genuine oceanographic expedition less than a century ago.] We now view the sea as a dynamic system that has interplay with the atmosphere above as well as with the earth's crust below. Her tides ebb and swell in the estuaries of our rivers. These in turn drain the land, carrying salts, silt, and (after heavy rains) precious soil down to the sea."

And the cycle goes on: "Evaporation from the sea is the source of most of the rain that falls on the land, and the water that flows downstream as a result is but one link in the all-important cycle that transports water molecules--to state the process as simply as possible--from ocean to clouds to rain or snow to soil to lake or river and then back to the sea."

Bardach says that oceanographers face enormous research tasks. While echo-sounding devices that permit the profiling of the sea bottom have been available for years, "the ocean is so vast that at present there do not exist detailed charts even for all inshore areas, to say nothing of the deep ocean basins."

Today, SCUBA (self-contained underwater breathing apparatus), diving saucers, atomic

submarines, and bathyscaphes afford a better view of the mysterious underwater world. But, says the author, the great needs are time, study, and money--mostly money.

To Help Feed World

Perhaps the sea's greatest importance, Bardach states, is that its own inhabitants can supply all-important proteins to the earth's inhabitants.

"There is hardly a sea animal that cannot be eaten after proper preparation. Yet we utilize but a small number of all species of animals that make their home in the sea. Of the 25,000 or more existing species of fish we capture consistently for food only about 200. Of the mollusks such as clams and oysters, and of the crustaceans, including shrimp, we use proportionally even less."

Much more light must be shed on harvesting sea life. Bardach explains: "Fishing today is still the stalking of an invisible quarry. Even on the vast commercial scale practiced by the Japanese and Russians, it amounts simply to the taking of nature's surplus. As yet we can do almost nothing to influence the abundance of most marine animals and, beyond certain limits, animal populations cannot be exploited without depleting them."

While some whales and fish stocks have been overharvested, other species are largely untouched, the author points out. The abundant hakes of the North Atlantic, for example, remain beyond present fishing tools.

Other Ocean Wealth

The great continental shelves may contain as many mineral deposits as dry land. There are many possibilities for producing food and other materials--from seaweed cosmetics to sponge-produced antibiotics.

The domestication of land plants and livestock was "one of the most momentous of human cultural advances. Marine plants and animals have really not yet been subjected to the combination of science and husbandry skills that could now be brought to bear on them."

Bardach concludes: "Gathering knowledge about man's interaction with the sea, and truly beginning to understand it, should help us guard against the kind of mistakes we made on land."



Foreign Fishing Off U. S. in January 1968

IN NORTHWEST ATLANTIC

Sixteen foreign fishing vessels (15 Soviet and 1 Polish) fished off southern New England and New York during January. This compares with 19 in December 1967; the 19 included vessels from East and West Germany.

Soviet: The number of vessels increased from about 6 stern trawlers early in the month to 12 by month's end. This was first evidence of increased activity since October 1967. In late January 1967, only a few vessels (believed doing exploratory fishing) were sighted off southern New England.

Throughout January, the vessels were dispersed widely in small groups along the 100-fathom edge of the Continental Shelf--from south of Montauk Point, Long Island (between Hudson and Block Canyons), to areas south of Nantucket Island off Massachusetts. Moderate catches observed on board several vessels appeared to be whiting (silver hake) and red hake.

One or two stern trawlers were reported fishing off Virginia. Catches were not determined.

A factory stern trawler ("Atlantik" class) made debut in Northwest Atlantic. The vessel, "Peter Lizyukov 7117," fished off southern New England and New York.

Polish: Late in January, one stern trawler was sighted among Soviet vessels off southern New England. No catches were observed. Possibly, the Poles are showing some interest in red hake for the future. From August to November 1967, sizable fleets fished heavily for herring on Georges Bank and southern New England. This ended in late November 1967.

East & West Germany: No sightings reported.

Soviet Violations of Mid-Atlantic Agreement: The U. S.-USSR Mid-Atlantic Fisheries Agreement, signed Nov. 23, 1967, has required expanded enforcement and surveillance efforts. These are conducted jointly by the U. S. Coast Guard and BCF.

In January, 5 separate violations of the treaty area, involving 5 individual Soviet vessels, were observed. In each case, between 1 and 3 vessels were fishing actively inside the east boundary of the "no fishing" treaty area. Catches on board several vessels were identified as whiting and red hake.

IN GULF OF MEXICO

No foreign fishing vessels were sighted during January. Soviet vessels continue to transit southward to their fishing grounds off South America. They use the Havana fishing port as supply base. Scattered vessels were seen on Campeche Banks, probably doing exploratory research.

OFF CALIFORNIA

Soviet: No vessels were sighted in January. In January 1967, only a few vessels fished off California.

OFF PACIFIC NORTHWEST

Soviet: Fishing was limited. Only 5 different vessels were sighted: 3 factory stern trawlers (BMRT's), 1 medium refrigerated side trawler (SRT-M), and 1 refrigerated transport. Three of the vessels were research or exploratory types--assumed searching for winter concentrations of fish for the fleet.

Only one vessel (the research vessel "Ogony") was observed on January 30 off the Columbia River with fish (about 1,000 pounds of Pacific ocean perch), although others were fishing. Fishing effort in January 1968 was about the same as in January 1967.

Japanese: Three stern trawlers operated off U. S. Pacific Northwest coast, but only during part of January. Early in month, all 3 were present; by mid-month, only 2 remained; by month's end, only one. Pacific ocean perch (about 8,000-10,000 pounds) were seen on one deck.

OFF ALASKA

Soviet: The number of vessels fishing increased from about 75 in early January to about 110 at month's end. This increase resulted from buildup of flounder fleet in eastern Bering Sea, and beginning of herring fishing in central Bering Sea.

The Soviet Pacific ocean perch fishery in the Gulf of Alaska was confined to coast of southeastern Alaska in eastern Gulf throughout January. The number of vessels increased from 15 factory stern trawlers (BMRT's), 1 medium refrigerated side trawler (SRTM) and 1 base ship in early January--to 15 BMRT's, 2 SRTM's, 1 base ship, 1 tanker, and 2 other vessels by month's end. In previous years, SRT side trawlers were primary fishing vessels. During previous winters, 50-100 side trawlers were active in the Gulf.

While the number of vessels now used in the Gulf is considerably less than in previous years, the fishing capability is about the same. This is because catch rate of present vessels is three times that of smaller side trawlers.

The flounder expedition in the eastern Bering Sea, which began December 1967, increased from about 50 vessels in early January to about 70 by month's end. Soviet sources reported about 400 metric tons were caught each day in eastern Bering Sea in first 10 days of January. Presuming that about 40 of the 50 vessels in early January were trawlers, this would mean a daily catch of 10 tons per trawler.

Soviet sources reported that an SRTM was dispatched to central Bering Sea in early January to explore for herring. In mid-January, the vessel caught 20 tons of herring in one day. It was joined by "columns" of large fishing vessels (presumably BMRT's). Also, daily catches of individual BMRT's exceeded 30 tons. At least a dozen trawlers engaged in this fishery in January.

A fleet of 6-12 SRTM freezer trawlers engaged in deep-water trawling north of Fox Islands in eastern Aluetians. Similar expeditions were conducted by SRTM's in this area in 1967. Observed catches were primarily sablefish and arrowtooth flounder.

Japanese: The number of vessels off Alaska dropped from about 50 in early January to about 35 just after mid-month, and then increased to about 44 at month's end.

The Gulf of Alaska ocean perch fishery was continued at a low level. This has been pattern of previous winters. The Japanese effort, like the Soviets', was confined to eastern Gulf throughout January. Two factory trawlers fished off southeastern Alaska coast and two on Yakutat grounds during most of January. At month's end, only one vessel was fishing. Joining her was another factory trawler. Also arriving at month's end was a small factory trawler that began fishing on Yakutat grounds.

Four factory vessels, accompanied by about 38 trawlers, fished in eastern Bering Sea during first half of January. These fleets fished primarily on and along edge of Continental Shelf, just north of Unimak Island. They caught Alaska pollock, gray cod, and flounders, which were processed primarily by freezing. About mid-month, 2 fleets returned to Japan. The 2 remaining fleets shifted to Alaska pollock grounds north of Fox Islands in eastern Aleutians where they remained for rest of month. By January's end, one factory trawler had returned from Japan and began operations southeast of Pribilof Islands. It was accompanied by about 8 trawlers that caught Alaska pollock and flounder.

Early in January, 3 independent factory trawlers fished on Continental Shelf just north of Unimak Island. They caught flounders (yellowfin soles), which were frozen. By mid-month, they had been joined by 2 more factory trawlers; all 5 fished along 100-fathom curve between Unimak Pass and Pribilofs. They caught mainly Pacific ocean perch. These vessels continued fishing during remainder of month; late in January, they were joined by another trawler.

Six Japanese long-line vessels fished for sablefish in the Gulf of Alaska. During first 3 weeks, 2 long-liners fished off southeastern Alaska, and one was located off Kodiak Island. Late in January, the latter vessel moved to off southeastern Alaska, and the other two returned to Japan. Three other long-liners began operations off southeastern Alaska late in January.



STATES

California

FISHERIES ARE PART OF
EDA STUDY FOR SAN DIEGO

A 3-phase, 18-month study aimed at providing new jobs in ocean-oriented industries in San Diego, Calif., was announced by the Economic Development Administration (EDA). EDA approved \$115,000 in technical assistance funds for the study.

The money was requested by San Diego's Community Development Department. The City will add \$10,000 to the EDA funds.

The first phase will take 6 months. It will determine the feasibility of establishing a tuna cold-storage plant and cannery, and a fish-meal processing plant. San Diego officials estimate that successful operation of such facilities could provide 400 to 1,000 new jobs in the area. It also will include a survey to see whether it is possible to set up a fishermen's cooperative for marketing and other services. This could increase annual income of fishermen.

Second and Third Phases

A second 6-month phase will determine the practicability of plants to process goods that now cross San Diego docks when entering or leaving the U. S. The survey will determine what items could be processed to reduce bulk, such as making plywood from logs, or compressing unrefined chemicals.

The final phase will start at the same time as the second and take about one year. It will involve compiling a list of the types of ocean-oriented firms with the best potential for creating jobs. It also will prepare a master plan for establishing firms.

* * *

ANCHOVIES DOMINANT IN
PELAGIC FISH SURVEYS

During 1967, 8 pelagic fish surveys were made in the California Current system from the Oregon border to Magdalena Bay, Mexico, reports The Resources Agency of California. Most of the effort was concentrated in southern and central California waters. The prin-

cipal survey methods were echo-sounding transects and midwater trawling.

Anchovies dominated all other species in numbers and in biomass. They were distributed in quantity everywhere but north of San Francisco. The surveys indicate that southern California is a major population center with a seasonal peak abundance in spring, when the adult population concentrates for spawning.

In central California, the anchovies were very large adults. Their distribution is seasonal. The largest quantities occur in summer and fall, and there is a marked scarcity in winter and spring. The echo-sounder surveys, along with tagging, indicate that these fish migrate in and out of this area from southern California.

Off Central Baja California

A second anchovy population center was found off central Baja California, Mexico. The Resources Agency believes there is strong evidence that these fish are a separate population from the California fish. Although the size of this population has not been determined, it appears about the same as the California population.

In spring, the behavior of anchovies in southern California is favorable for conducting a quantitative survey with echo-sounding transects. A June 1967 survey produced an estimate of 1.8 million schools. If the size of these schools could be determined accurately, a reasonable estimate of total population size could be made.

Lanternfishes were the second most abundant fishes. They were distributed widely--but nowhere abundantly, or concentrated. Sardines were detected and sampled only in Baja California. No large quantities were found, nor was there evidence of a strong incoming year class. Pacific mackerel were very scarce in all regions surveyed.



Florida

EDA APPROVES FUNDS TO DEVELOP JOBS IN FISHING INDUSTRY

The Economic Development Administration (EDA) has approved \$150,000 in technical assistance funds to help develop methods of canning and marketing mullet, mackerel, and bonito in order to create new jobs in the southern fishing industry. A seafood firm in Miami, Fla., was the applicant.

Principal Species

The firm will conduct an 18-month project in cooperation with Florida and BCF. At present, mullet, Spanish and king mackerel, and bonito, which will be the principal species studied, are not being fully utilized. Successful processing and marketing programs for these species would create jobs in food plants and the fishing industry in Florida and other southern States.

Total cost of the project will be \$232,500. Florida and BCF will invest some funds to cover services to complete the financing. The applicant's plant and other facilities will be used to conduct the project.

Aspects of Study

The funds will permit continuous fish processing to develop methods and standards for cannery operations. The project also will include preparation of recipes and demonstrations for dieticians and others responsible for preparing food in institutions. Further, the most profitable use of byproducts from the food processing will be determined.

BCF had reviewed proposal and recommended it to EDA.

* * *

GREATER USE OF CALICO SCALLOP BEDS EXPECTED

Increased commercial utilization of large, underutilized calico scallop beds off Florida's east coast is expected. During September-December 1967, 5,035 bushels of scallops were landed by 4 vessels at St. Augustine and Port Canaveral.

On Feb. 1, 1968, at least 5 more vessels fishing for processors in Georgia and North

Carolina were getting ready to enter this fishery.

In 1967, the calico scallop catch off North Carolina dropped. This increased interest in developing the Florida beds, which were outlined first by BCF exploratory surveys in 1959-60.



Texas

FPC PILOT-RESEARCH PLANT AT TEXAS A & M

A fish protein concentrate (FPC) pilot-research plant is operating at Texas A & M University. The plant is wholly funded by Sweco, Inc., Los Angeles. It is operated jointly by Sweco and the University's chemurgic research laboratory.

Objectives

The FPC pilot plant will work toward these objectives: (1) Determine plant design and equipment specifications for future large-volume commercial production of FPC. It will use a single solvent (isopropyl alcohol) extraction process; (2) produce sufficient test quantities of FPC to be incorporated into food and for market evaluation studies by interested industries; (3) investigate feasibility of using a variety of fish for commercial production of FPC; and (4) conduct intensive test program to determine most economical method to produce high-quality FPC on a mass-production basis. ("Oil, Paint & Drug Reporter," Jan. 29, 1968.)



Oregon

FIRST STATE-U. S. FINANCING OF SALMON HATCHERY

The Oregon Fish Commission has awarded a \$402,729 contract to construct the first salmon hatchery financed jointly by the State and the U. S. The Federal funds were authorized under the Anadromous Fish Act, P. L. 89-304.

The hatchery, scheduled for completion in October, will be on Elk River, Curry County,

near Port Orford. It will have potential rearing capacity of 2 million salmon a year for release in southern coastal streams.

In coho salmon, this release will produce an estimated 15,000 spawners, and a catch of 45,000 fish.



Oregon-Washington

FALL CHINOOK FROM U. S. HATCHERIES PLANTED IN WILLAMETTE

Interior Department's Fish and Wildlife Service planted 8,000,000 baby salmon in tributaries of the Willamette River early in February. It was part of a continuing effort by U. S. and State agencies to establish a run of Fall Chinook there before the Willamette Falls fishway at Oregon City is completed.

This spring, about 1,500,000 Fall Chinook now being raised at Eagle Creek National Fish Hatchery also will be released into the Clackamas River, a Willamette tributary.

Donald Johnson, BCF Regional Director, reported that 1,000,000 of the fry and fingerlings were transported by trucks from Little White Salmon National Fish Hatchery, and 7,000,000 from Spring Creek National Fish Hatchery, both in Washington State. BCF pays for both hatcheries, which are operated by the Bureau of Sport Fisheries and Wildlife.

Oregon and Washington Cooperate

The Washington Department of Game and the Oregon Game Commission provided tank trucks to help move the large amount of baby fish. About 400,000 small fish were transported in each truckload. Research personnel of the Fish Commission of Oregon helped select appropriate release sites.

The baby salmon were released at various points in the Molalla, South Santiam, Little North Fork Santiam, North Santiam, and Clackamas Rivers.

The fish stay in these tributaries for a short period, then begin swimming down the Willamette, into the Columbia, and finally into the Pacific Ocean. Survivors will return

in 3 or 4 years as mature fish. They will spawn in the streams where they were planted.

The fishery agencies that conducted the planting program hope that eventually an annual run of 100,000 Fall Chinook will be established to pass the Oregon City Falls via the improved Willamette Falls fishway.

Fishermen May Benefit

Johnson said: "We are complementing the planting of Fall Chinook by the Fish Commission of Oregon with this release of the fish from the national hatcheries. On the basis of returns through the partially completed fishway of earlier releases of Fall Chinook salmon, this program of stocking hatchery fry and fingerlings appears to be paying off."

He said establishment of a self-sustaining run of Fall Chinook in the Willamette River would add greatly to the commercial and sport fishery. Fishery agencies hope that pollution problems in the lower Willamette will be resolved by the time the fish come back from the ocean.



Virginia

VIMS SCIENTISTS TAG STRIPED BASS

Fishery scientists of the Virginia Institute of Marine Science (VIMS) at Gloucester Point, Va., are tagging striped bass (rockfish), an important sport and commercial fish along the mid-Atlantic seaboard. During the first half of February, 1,500 stripers 6 to 30 inches long were tagged and released in the York River. In the third week, the scientists shifted to the Rappahannock River to begin tagging there as soon as the river is ice free.

"The tagging will be spaced over the biological year of the fish," said Dr. Edwin B. Joseph, Assistant Director of VIMS. The present effort is to locate and tag fish before they reach the spawning grounds in spring. The next major tagging program is scheduled for just after the spawning season, when many adult fish are returning from fresh water just above the brackish part of the rivers. The third tagging effort will take place in the fall.

"The success of these tagging programs will depend largely on the cooperation of both

sport and commercial fishermen returning tags recovered from the fish they catch," Dr. Joseph emphasized.

The tags being attached to striped bass are yellow, plastic discs, about $\frac{1}{2}$ -inch diameter. On one side, there is an identifying number; on the other, "Return tag to VIMS, Gloucester Point, Virginia 23062, REWARD." One dollar is paid for each tag returned.

What Tags Can Tell

Returned tags help scientists answer such questions as: "Where within a river system do specific populations of fish move?," "Does one population of fish intermingle with another?," "Do specific fishing methods select fish of given size and age?," "What proportion of the total catch is taken by sport-fishermen and by each type of commercial fishing gear used?," "How many fish of each age group die each year during the pre-migratory phase of their life?," "What is the relative proportion of fish of each year-class (fish of the same age) in the total catch?"

The answers help marine scientists develop management plans to ensure the best use of this valuable resource.

The work is supported in part from Federal and state funds. It is a cooperative study of VIMS scientists and the U. S. Bureau of Sport Fisheries and Wildlife.



New York

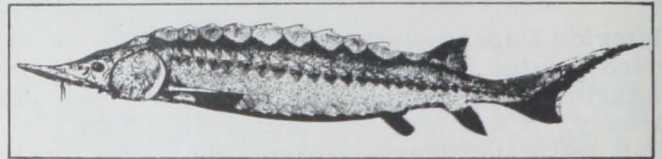
7 $\frac{1}{2}$ -FOOT STURGEON FOUND IN HUDSON

Optimists interpret the finding of a 7 $\frac{1}{2}$ -foot sturgeon in the Hudson River as a sign that the valuable fish has come home after a half-century Odyssey. No one is sure why it left, but overfishing and pollution are mentioned most often.

The Hudson River Valley Commission reported the killing of the 7 $\frac{1}{2}$ -foot female Atlantic sturgeon by a Verplanck, N. Y., fisherman who used his boat's propellers to do it. The sturgeon contained over 50 pounds of roe.

Other Sturgeon Reported

The November 1967 issue of "Sea Secrets," published by The International Oceanographic Foundation of Miami, Fla., stated: "Large sturgeon have been reported at other places on the Hudson over the past few years, and some have even been hooked, although these escaped because the anglers did not have the



extremely heavy gear necessary to land such fish. There has been no commercial sturgeon fishery on the river since the turn of the century, when the stocks vanished in the face of overfishing and pollution. Before that, 'Albany beef,' as the sturgeon were called, was a major resource of the Hudson Valley. Sturgeon are the source of what is probably the most valuable of fishery products--caviar. In one peak year the sale of Hudson caviar reached \$6 million. If the sturgeon return in force to the Hudson, a resurgent fishery will go a long way towards defraying the cost of cleaning the river."

The Giant Fish

The salt-water sturgeon is a toothless, bottom-feeding fish found in the world's non-tropical seas. In the spring, it arrives in rivers to spawn; it may remain all summer. Species similar to the sturgeon have become landlocked in fresh water.

In the Soviet Union, there is a large demand for the roe, or eggs, of sturgeon as caviar.



Maine

CANNED SARDINE STOCKS LOWER AS 1968 BEGAN

Canners' stocks of Maine sardines on Jan. 1, 1968, were down 16,000 cases from a year earlier and sharply lower than in the two previous years. This was reported by the Census Bureau.

Type	Unit	1/1/68	1/1/67	1/1/66	1/1/65
Distributors	Actual Cases	222,000	232,000	267,000	238,000
Canners	Std. Cases ^{1/4}	339,000	355,000	520,000	538,000

^{1/4} 100 3³/₄-oz. cans equal one standard case.

Light 1967 Pack

The 1967 pack totaled 1,181,000 standard cases, compared with 1,277,000 standard cases packed in 1966, according to the Maine Sardine Council. The light 1967 pack was due mostly to extended periods of bad weather and generally poor spring fishing. In 1967, as in 1966, 23 canning plants operated during the year. One plant has since been dismantled.

The Council has reported that the 1968 pack to February 10 was 83,000 standard cases. This compares with 68,000 cases for the 1967 period. Fishing by purse seiners was reported good and weather favorable. Fifteen canning plants were operating.



Alaska

THE FISHERIES IN 1967

The 1967 commercial catch of fish and shellfish totaled about 370 million pounds live weight, reports BCF Juneau. The value to fishermen was about \$47 million. This is the lowest catch since 1960's 359 million pounds worth \$41 million.

The 1967 catch was 36 percent less in volume and 42 percent less in value than the 1966 landings of 582 million pounds valued at \$81 million.

The marked decline in 1967 landings was due to greatly reduced catches of salmon, king crab, and herring--together down 237 million pounds from 1966. For the first time in history, the volume of salmon landings--131 million pounds--was overshadowed by another species--135 million pounds of king crab.

Species	1967 ^{1/}		1966	
	Quantity	Value	Quantity	Value
	1,000 Lbs.	US\$ 1,000	1,000 Lbs.	US\$ 1,000
Halibut	33,000	5,000	33,354	7,774
Herring	9,500	140	19,256	289
Sablefish	348	42	2,311	273
Salmon:				
King	10,300	3,200	9,350	2,949
Red	52,300	11,000	92,767	19,737
Coho	12,400	3,800	16,113	3,705
Pink	26,700	3,500	162,866	22,093
Chum	29,300	3,300	52,230	5,718
Total	131,000	24,800	333,326	54,202
Misc. Fish	266	45	150	26
Herring Eggs on kelp	378	285	662	496
Crabs:				
King	135,000	13,500	159,202	15,670
Dungeness	11,500	1,380	5,053	606
Tanner	80	8	-	-
Shrimp	46,300	1,852	28,193	1,288
Clams	120	12	29	9
Grand Total. . .	367,492	47,064	581,536	80,633

^{1/}Preliminary data supplied by Alaska Department of Fish and Game.

Several Bright Spots

Despite the reduction in overall landings, there were several bright spots. Dungeness crab landings totaled 11.4 million pounds, up 130 percent from 1966. Shrimp landings were a record 46.3 million pounds, up 60 percent. Tanner crab landings, though only 80,000 pounds, also were a record. Salmon roe production is estimated at 6 million pounds with a raw product value of \$1 a pound. This is over 50 percent of the value of the U. S. Pacific halibut fishery.

Commercial Scallops

Scallops were landed for the first time commercially in December 1967. "The resource is estimated to be large, the product is rated excellent, and the price is the highest in history."

The port of Kodiak had landings of 111 million pounds worth \$10 million. It dropped from third to fourth place among U. S. ports in value of fishery landings. It was behind San Pedro, Calif., \$29.5 million; Brownsville, Texas, \$16.5 million; and New Bedford, Mass., \$15.7 million; it was ahead of Boston, \$9.4 million.



BUREAU OF COMMERCIAL FISHERIES PROGRAMS

Chemical Control of Oyster Predators Pays Off

Chemical methods are showing convincingly their commercial value in controlling oyster predators in New Haven Harbor, Conn. About 250,000 bushels of oysters from the 1966 spatfall, planted on about 200 acres of bottom, are being treated with lime for starfish control. Also, granular Polystream is being used to control oyster drill.

Losses of oysters to starfish and drill during May-November 1967 were 4-5 percent. This compares with over 50 percent loss for untreated grounds with similar oyster plantings. There was a total loss of the 1958 commercial oyster set to predators before the end of its first year.

Milford Lab Methods Used

The 1967 achievement was the first large-scale commercial demonstration of the effective control methods developed at BCF's Milford (Conn.) Laboratory. It shows the importance of these methods to a successful mariculture system for oysters.

Such routine treatment of oyster grounds can be expected to increase production from the usual 1 to 1 per bushel of seed planted to an 8-10 to 1 per bushel planted over the 3½-year period required to reach harvest size.

Long Island Fishery May Benefit

This is a considerable economic return over planting without chemical controls. Combined with hatchery production of seed and 1966 commercial set, it may contribute to a resurgence of Long Island's oyster fishery.



Collapsible Lobster Pot Is Suited for Continental Slope Fishing

Personnel of BCF's Gloucester (Mass.) Exploratory Fishing Base have built a proto-

type collapsible lobster pot of a size suitable for fishing on the Continental Slope.

When opened, the pot is 3 x 4 x 1½ feet. It collapses to 3 feet x 4 feet x 3⅝ inches. Five folded pots can be stored in the exact space taken by one opened pot. This will be important when transporting many pots a considerable distance from port to fishing grounds.

3 'Heads' In Pot

The pot has a valuable feature: 3 "heads." Only the ties at the end of the "skate" head leading into the "parlor" section need to be modified to make trap collapse quickly and easily. This can be done by using elastic or spring-loaded ties--or through quick-detaching method for clipping ties to pot frame, as used on prototype pot.



These Lobsters Prefer Artificial Reef as Home

An artificial reef built over a year ago near the mouth of Boothbay Harbor, Maine, has 6 times more lobsters on it than are present in the adjacent natural habitat--and 12 times more than colonized it during its first year.

In November 1966, personnel of BCF's Boothbay Harbor Laboratory completed the artificial reef to provide a habitat for lobsters under study. The reef covers about 10,000 square feet of bed rock, cobble, and mud-covered ocean bottom in 50 to 80 feet of water.

Monthly throughout 1967, the lab's SCUBA team observed and counted the reef's inhabitants. A few lobsters moved onto the reef during the first 2 weeks and, since then, the population has increased steadily.

A year after construction, in November 1967, observations showed the apparent density of lobsters about half that in adjacent natural habitat--and 3 times that existing on the reef's site before it was built.

Population Booms

Since its November report, the SCUBA team has reported "a dramatic increase in the relative apparent density of lobsters"-- 10 times more than are found in adjacent natural habitat and 12 times more abundant than during reef's first year.

The reef lobsters have been joined by scallops, sea urchins, anemones, starfish, snappers, sculpins, rock eels, cod and redbfish. Colonial hydroids are abundant on the exposed rock surfaces. The siltation level is where it was 2 months after reef was built.

The reef is open to commercial lobster fishing. About 10 to 15 traps have been set on or adjacent to it.



Aid to Florida's Thread Herring Fishery

On Feb. 5, a Florida State court lifted the ban on the developing thread herring fishery off the State's west coast. The fishery had started well in 1967, but the State closed it when it decided to enforce a law prohibiting the incidental catching of food fish.

The large, unused thread herring resource is a valuable alternative for the menhaden industry.

The staff of BCF's Biological Laboratory at St. Petersburg Beach presented data at the court hearings that food fish were less than one percent of the catches. BCF's thread-herring biological research program, which developed the data, already is considered a good investment. BCF's new research vessel, "Oregon II," has been helping the fishing fleet find and catch the fish.



Aid to A.I.D.

Two BCF experts served as members of a survey team sent to Africa by the U. S. Agency for International Development (AID) to explore the problems of producing, distributing, and marketing fish protein concentrate (FPC).

The two were John Dassow, Food Technologist of the Seattle Technological Laboratory, and Ben Jones, Director of the Juneau (Alaska) Exploratory Fishing and Gear Research Base. They accompanied Roy Christey, Program Coordinator of AID's Food From The Sea Service. The team visited Morocco, Uganda, Ghana, and bases on Lake Victoria.

The BCF specialists reported their findings to the State Department on Feb. 16.



"Oregon" Surveys Midwater Schoolfish

BCF's exploratory fishing vessel Oregon returned to St. Simons Island, Georgia, on Jan. 21 after completing the first in a series of 6 bimonthly midwater schoolfish survey cruises.

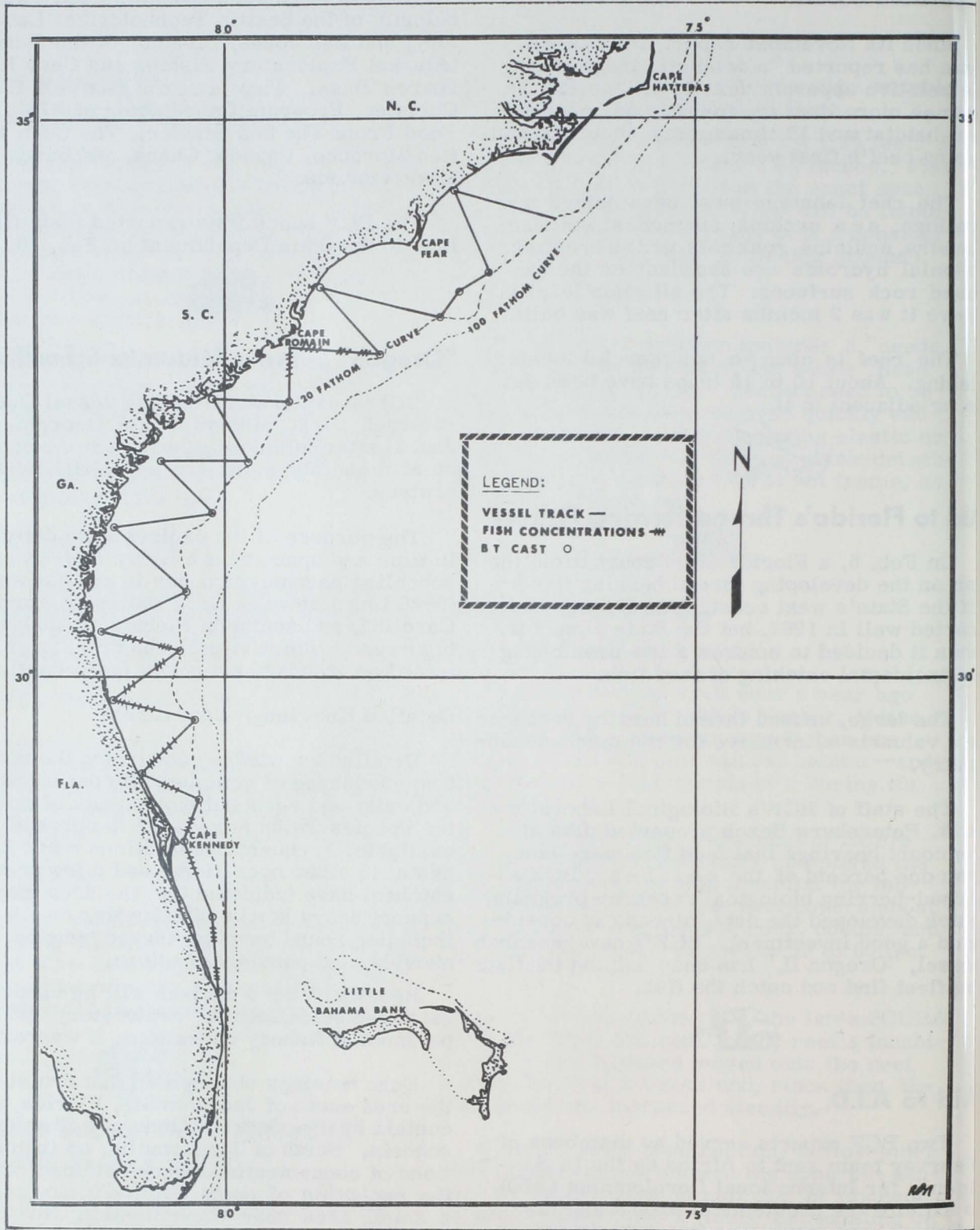
The purpose of the cruises is to determine in time and space where heavy mid-water schooling phenomena occur in coastal waters (5-20 fms.) between Cape Hatteras, North Carolina, and southern Florida by analyzing high-resolution vertical echo tracings obtained on standard transects (see chart).

Detailed Knowledge Unavailable

Detailed knowledge concerning the relative abundance of commercial concentrations and daily and seasonal movements of midwater species in the study area is currently unavailable. Frequent observations made incidental to other operations, and a few trial catches, have indicated that the area may support heavy stocks of midwater dwellers, including round herring, thread herring, anchovies, and possibly sardines.

Results of the 6 cruises will be used to establish guidelines for exploratory and experimental fishery operations, if warranted.

Echo tracings obtained on this cruise show the area south of Jacksonville, Florida, to contain heavy concentrations of midwater schools. North of Jacksonville, no indications of concentrations were obtained, with the exception of some limited schooling in a small area near Cape Romain, South Carolina.



R/V Oregon Cruise 125, Jan. 8-21, 1968.

Purse Seining Off Africa's West Coast

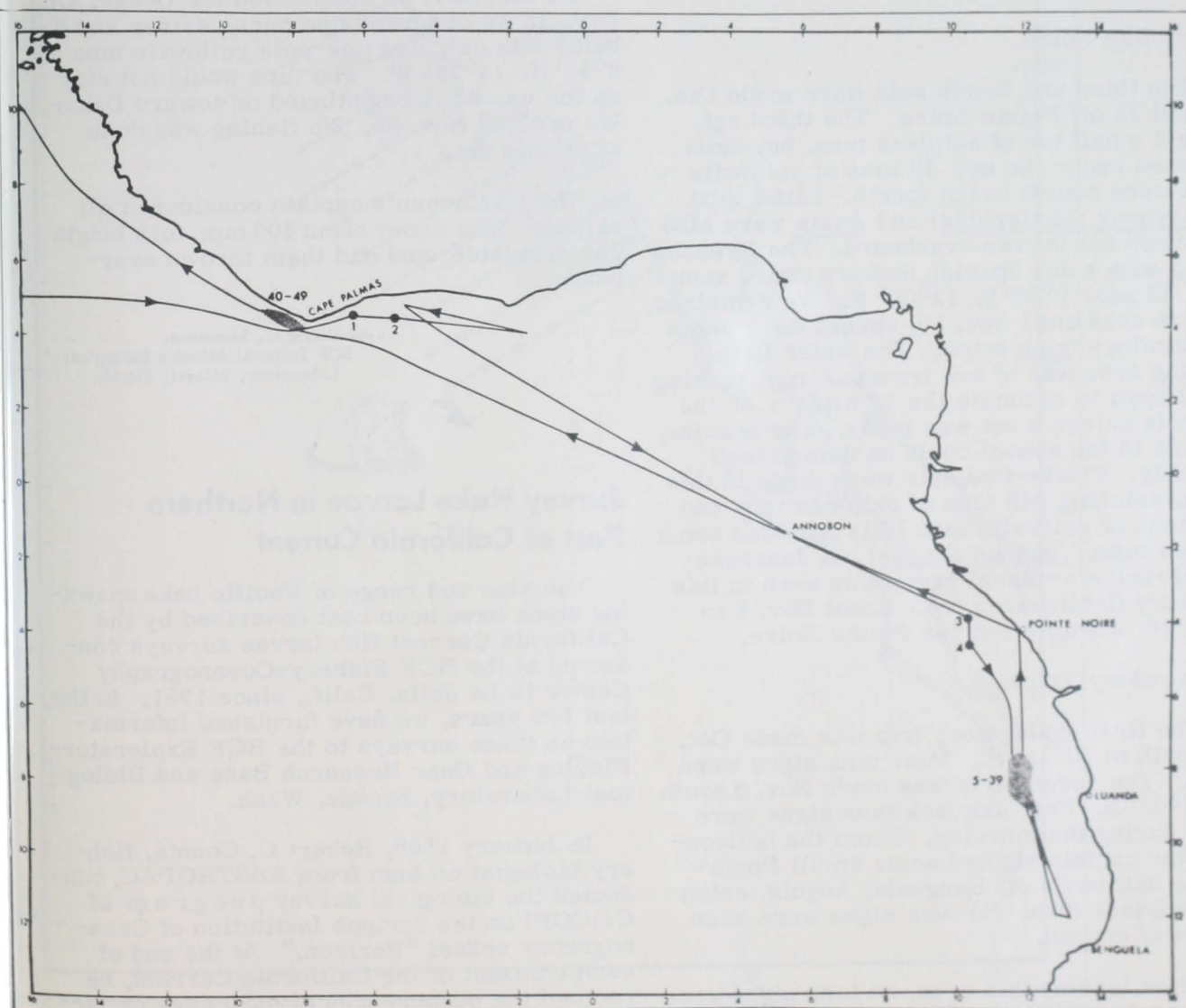
From Oct. 2, 1967, to Dec. 6, 1967, I was a BCF observer aboard the M/V "Caribbean," which purse seined for tuna off the west coast of Africa. The 167-foot vessel has a net about 575 fathoms long and 48 fathoms deep, a seine skiff 34 feet by 19 feet, 2 speed boats, and a helicopter. It has a capacity of about 800 tons of tuna in 14 brine tanks. The helicopter played a great part in the trip's success. It located most of the tuna schools and helped in the setting of the net by radio communication with the vessel.

The helicopter not only helped the Caribbean but also 2 other U. S. seiners: "Southern Seas" and "Day Island." We were in

constant communication with these vessels and spotted tuna for them as much as possible.

First Set off Cape Palmas

The vessel left San Juan, Puerto Rico, Oct. 2. Final preparations for fishing were made while crossing to Africa and were completed by Oct. 14. The first set was made on a school of skipjack tuna (*Katsuwonus pelamis*) showing at the surface near Cape Palmas during the morning of Oct. 15; it was unsuccessful. A strong current caused the cork line to sink and made it possible for the tuna to go over the net. A second set made later in the day caught 30 tons of skipjack tuna and some frigate mackerels and bullet mackerels (*Auxis thazard* and *A. rochei*), which were



Approximate cruise track and set positions.

thrown overboard. No tuna signs were seen the next 2 days so we proceeded to Annobon Island.

On Oct. 18, the Caribbean's captain talked to the captain of a French combination purse seine-bait boat. The latter reported that the French fleet was fishing off Angola and making fairly good catches of yellowfin tuna (Thunnus albacares).

We arrived off Annobon Island on Oct. 20. A few tuna schools were seen around the island, but they would not stay up so that a set could be made. Because the bottom was rough, the captain did not want to chance losing the net so early in the cruise. We then headed for the coast of Angola in search of the French fleet.

Off Pointe Noire

The third and fourth sets were made Oct. 21 and 22 off Pointe Noire. The third set caught a half ton of skipjack tuna, but most escaped under the net; 40 tons of yellowfin tuna were caught in the fourth. Little tuna (Euthynnus alletteratus) and Auxis were also captured but thrown overboard. The French, along with some Spanish seiners, were seen Oct. 23 near 9°00' S., 12°00' E. We remained in this area until Nov. 10, except for 2 short exploratory trips south. The water in this fishing area was of low transparency, making it difficult to estimate the tonnage of the schools before a set was made. The species of tuna in the school could be determined visually. Thirty-five sets were made in this area, catching 249 tons of skipjack tuna and 325 tons of yellowfin tuna (this includes some bigeye tuna, Thunnus obesus). A Japanese purse-seine 5-vessel group was seen in this primary fishing area from about Nov. 8 to Nov. 10, when we left for Pointe Noire.

Exploratory Trips

The first exploratory trip was made Oct. 24 south to 10°38' S. Poor tuna signs were seen. The second trip was made Nov. 8 south to 12°01' S. Fair skipjack tuna signs were seen during the morning. From the helicopter, the captain sighted some small Portuguese bait boats off Benguela, Angola, catching skipjack tuna. No tuna signs were seen in the afternoon.

After leaving this area, no tuna signs were seen again until Nov. 17 off Cape Palmas.

Ten sets were made from Nov. 17 to Nov. 21 (8 were on porpoise--common dolphin, Delphinus delphis schools--) and caught 89 tons of yellowfin tuna. The water off Cape Palmas was generally blue and clear. The yellowfin tuna swam beneath the porpoise schools (this could be seen from the helicopter) and made it difficult to determine the tonnage before the sets were made. The 2 speed boats and helicopter were used to herd the porpoise and thus the tuna into the net. Some sets were made without seeing any tuna with the porpoise. The 2 sets not made on porpoise captured only little tuna and Auxis. The yellowfin were all of the larger size (950 mm. fork length and above). No skipjack tuna or bigeye tuna were captured in this area.

We left Nov. 22 and headed for Dakar. On Nov. 23 we observed one purse seiner and 3 bait boats catching one-pole yellowfin tuna at 8°40' N., 14°36' W. The tuna would not stay up for us, so we continued on toward Dakar. We arrived Nov. 25. No fishing was done after this date.

The Caribbean's captain considered all skipjack tuna under about 400 mm. fork length unmarketable, and had them thrown overboard.

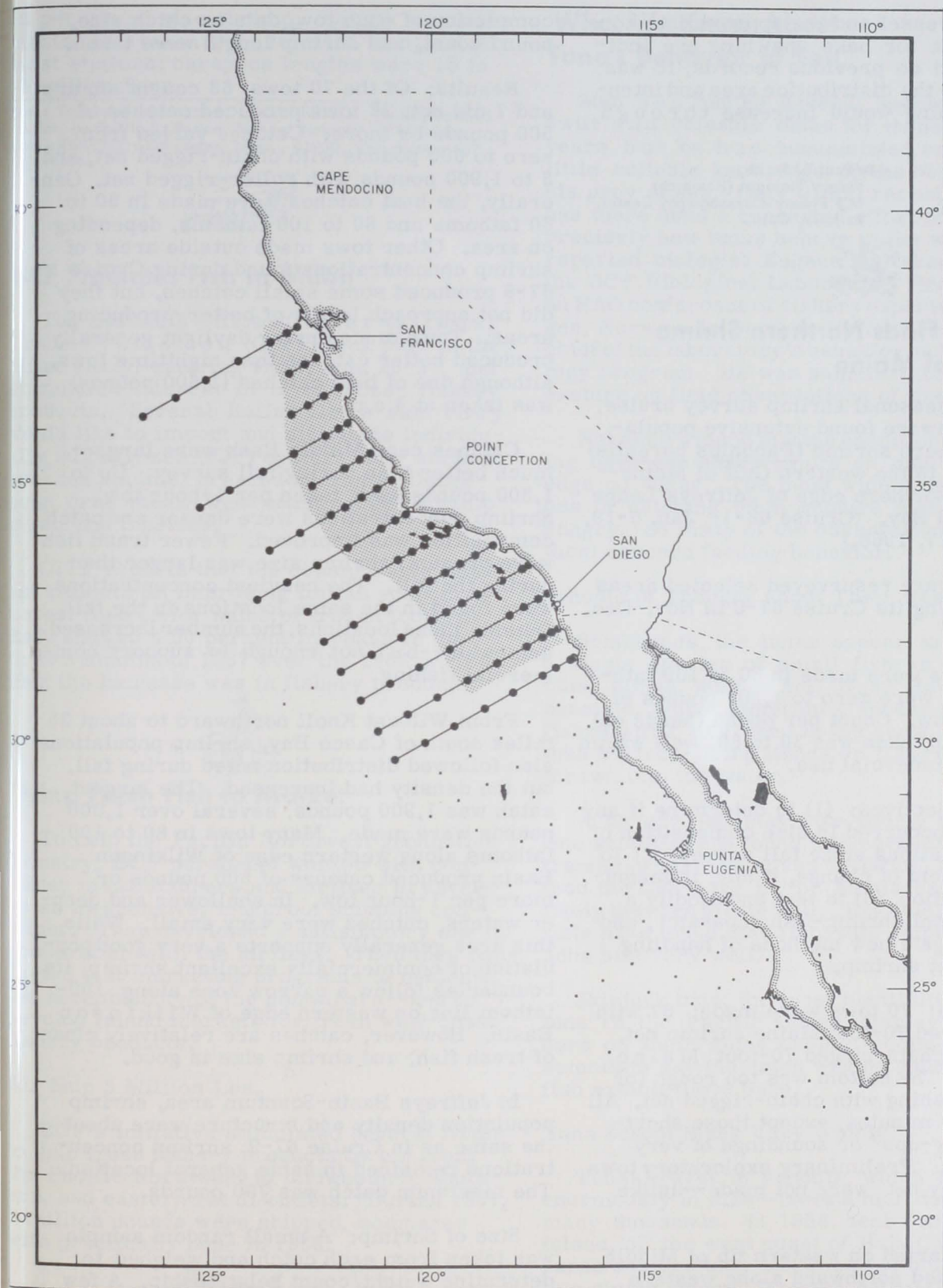
--By David C. Simmons,
BCF Tropical Atlantic Biological
Laboratory, Miami, Florida



Survey Hake Larvae in Northern Part of California Current

The size and range of Pacific hake spawning stock have been best described by the California Current fish larvae surveys conducted at the BCF Fishery-Oceanography Center in La Jolla, Calif., since 1951. In the last few years, we have furnished information on these surveys to the BCF Exploratory Fishing and Gear Research Base and Biological Laboratory, Seattle, Wash.

In January 1968, Robert C. Counts, fishery biologist on loan from EASTROPAC, conducted the biological survey program of CalCOFI on the Scripps Institution of Oceanography vessel "Horizon." At the end of each transect of the California Current, he radioed the occurrences of hake eggs or larvae. In the accompanying figure, the cruise



Cruise track of the Horizon, Cruise 6801, and the approximate zone of occurrence for hake spawning.

track of the vessel and the approximate zone of occurrence for hake spawning are indicated. Based on previous records, it was expected that the distribution area and intensity of spawning would increase through February.

--By Paul E. Smith,
Fishery Biologist (Research)
BCF Fishery-Oceanography Center,
La Jolla, Calif.



'Delaware' Finds Northern Shrimp in W. Gulf of Maine

During a seasonal shrimp survey cruise, the M/V Delaware found extensive populations of northern shrimp (*Pandalus borealis*) concentrated in the western Gulf of Maine--between the northern edge of Jeffreys Ledge and Cape Cod Bay. (Cruise 68-1: Jan. 6-19, Jan. 29-Feb. 7, 1968.)

The Delaware resurveyed selected areas explored during its Cruise 67-9 in Nov.-Dec. 1967.

Trawl tows were made in 30 to 109 fathoms; catches were zero to 1,900 pounds of shrimp per tow. Count per pound (heads on) for all shrimp taken was 30 to 60, well within range for commercial use.

Cruise objectives: (1) to determine if any changes had occurred in size composition of shrimp populations since fall survey, (2) to ascertain extent of change, if any, in magnitude and location, (3) to test and modify a new mechanical shrimp-fish separator, and (4) to investigate new methods of handling freshly caught shrimp.

Procedure: 70 tows were made: 67 with a roller-rigged 70-foot Maine shrimp net, and 3 with a chain-rigged 70-foot Maine shrimp net. The bottom was too rough for successful fishing with chain-rigged net. All tows were 60 minutes, except those shortened by "hang-ups" or soundings of very rough bottom. Preliminary exploratory tows with small try net were not made--unlike fall cruise.

Fishing started on western tip of Middle Bank, continued northward along western edge of Wilkinson Basin, and southward across Jeffreys and Scantum Basins. After

completion of each tow, data on catch size, pound count, and shrimp length were taken.

Results: Of the 70 tows, 63 caught shrimp and 7 did not; 22 tows produced catches of 500 pounds or more. Catches varied from zero to 600 pounds with chain-rigged net, and 3 to 1,900 pounds with roller-rigged net. Generally, the best catches were made in 50 to 60 fathoms and 80 to 100 fathoms, depending on area. Other tows made outside areas of shrimp concentrations found during Cruise 67-9 produced some small catches, but they did not approach levels of better-producing areas. Tows made during daylight generally produced better catches than nighttime tows, although one of best catches (1,600 pounds) was taken at 4 a.m.

Catches near Middle Bank were large--much better than during fall survey. Up to 1,300 pounds were taken per 1-hour tow. Shrimp concentrations were denser and catch composition was improved. Fewer trash fish were present; shrimp size was larger than during the fall. The heaviest concentrations were found in the same locations in the fall. Outside these locations, the number increased somewhat--but not enough to support commercial fishing.

From Wildcat Knoll northward to about 25 miles south of Casco Bay, shrimp populations also followed distribution noted during fall, but the density had increased. The largest catch was 1,900 pounds; several over 1,000 pounds were made. Many tows in 80 to 100 fathoms along western edge of Wilkinson Basin produced catches of 500 pounds or more per 1-hour tow. In shallower and deeper waters, catches were very small. While this area generally supports a very good population of commercially excellent shrimp, its boundaries follow a narrow zone along 100-fathom line on western edge of Wilkinson Basin. However, catches are relatively clean of trash fish, and shrimp size is good.

In Jeffreys Basin-Scantum area, shrimp population density and structure were about the same as in Cruise 67-9; shrimp concentrations remained in same general location. The maximum catch was 700 pounds.

Size of Shrimp: A small random sample was taken from each catch and weighed to determine weight/count relationship. A few catches produced shrimp of 30 to 35 per pound. Most of catches, however, were 35 to

50 per-pound size shrimp. Length measurements were taken from selected samples at most stations; carapace lengths were 15 to 33 millimeters.

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



BCF Promotes Fish in Milan

The Bureau's Office of International Trade Promotion (OITP) took part in the Milan (Italy) catering show, Jan. 20-27, and stimulated interest in U. S. frozen fishery products. Several Italian firms said they would like to import and distribute individually quick frozen (IQF) oysters, IQF shrimp, breaded shrimp, breaded scallops, Dungeness crab meat, west coast cooked shrimp meat, and lobsters.

OITP reports that the considerable interest reflects an improving Italian economy. Latest figures for sales of frozen foods in Italy showed a 50 percent increase in the first 9 months of 1967 over the 1966 period. Half the increase was in fishery products.



Flying Fresh Fish to Market

To help the Pacific Northwest groundfish industry, BCF personnel worked with container manufacturers and airlines to develop an inexpensive, leakproof shipping container. They developed a satisfactory one in cooperation with the airlines. Then they conducted test marketing programs to evaluate the acceptability of the containers--and to develop inland markets for fresh west coast fishery products.

Our Ship 3 Million Lbs.

BCF's initiative stimulated several firms to ship fresh fishery products by air from the Pacific Northwest to midwestern, southern, and eastern retail outlets. During 1967, 3 million pounds were shipped, compared with practically none in 1966.



What We Know About Tuna's Behavior at Sea

Man has hunted several species of the swift and valuable tunas for thousands of years, but he has accumulated remarkably little reliable knowledge of the behavior of his prey at sea. Only within recent decades has there been a concerted effort to describe precisely how tunas behave in the wild. So reported biologist Eugene L. Nakamura of the BCF Biological Laboratory, Honolulu, to an FAO conference of fishery experts in Bergen, Norway, in October 1967. Nakamura is chief of the laboratory's behavior and physiology program. He was summarizing the literature on field observations of the tunas.

Nakamura found that the conditions of fishing have set sharp limits on man's knowledge of tunas. The most widely used methods of catching them require that they be hungry. So many of the observations about them concern feeding behavior.

Schools of Thought About Their Feeding

Sometimes, the tunas appear to seek out a single species of small fish as prey; at other times, they do not. Near Hawaii, for example, tunas sometimes appear to prefer fishes that live deep in the ocean, rather than surface-living fishes or baitfishes thrown into the water.

A hungry fish may bite poorly or well. One scientist has found that between the extremes of starvation and satiation, the less food the fish have in the stomachs, the less likely they are to bite well. But other scientists have found that fish with empty stomachs bite very well.

Skipjack tuna, the most plentifully caught tuna in the Pacific Ocean, display vertical bars on their sides during feeding. Some scientists say the catch will be good when the fish exhibit these bars.

Tuna School Sizes Vary Widely

Tunas travel in schools, which can vary enormously in size--from a half dozen to many thousands. In 1958, near San Benito Island, off the west coast of Baja California, purse seiners took 4,000 tons of bluefin tuna in a single school. This is about three-fourths the catch of the entire Hawaiian skip-

jack tuna fleet in a whole year. In 1966, a BCF research vessel near the Bahama Islands came across a school of bluefin tuna that required $2\frac{1}{2}$ hours to sail across.

Almost all species of tunas have been reported in mixed schools of two or more species, Nakamura says. But, according to researcher Heeny S. H. Yuen of the Honolulu Laboratory, these "mixed" schools probably are distinct schools of different species drawn together by a common stimulus, such as food.

In the eastern Pacific Ocean, the largest U. S. tuna fishery, skipjack tuna and yellowfin tuna often are caught together in purse seines. Scientists have found that the excitable skipjack, when captured, calmed down when placed in presence of less erratic yellowfin.

Schools of Same-Size Tuna

Schools of tuna usually consist of fish of the same size. Even if two or more species are present, the fish are about the same size. Probably, this is because they can maintain only a certain swimming speed.

A Japanese scientist has observed that schools of skipjack tuna that bite well maintain an orderly formation, like marching troops; those that bite poorly are "disorderly."

Some tunas school at night. Schooling is thought to be a function of sight. Nakamura thinks the fish can see well enough at night to school either from moonlight or light shed by luminescent organisms. Fishermen use the luminescence of planktonic organisms disturbed by fish.

Water Temperature A Factor

In the eastern Pacific, purse seining for tuna has been most successful when a shallow, upper, mixed layer of the sea has been underlain by a "thermocline" with a sharp temperature gradient. That is, the temperature drops off sharply within a few dozen feet. This sharp gradient is widely believed to deter tuna from sounding (diving) and escaping the nets. However, it may not be temperature alone that causes fish to avoid the thermocline. The water there often is turbid and, sometimes, there is perilously little oxygen in the layer.

Seek Floating Objects

Like many other fishes, tunas appear to seek out floating objects. Some scientists think they use them as "landmarks" in a largely featureless sea. Recently, other scientists have said that the chief purpose of the floating objects appears to be shelter. In any event, tunas often are found near logs, driftwood, floating vessels, even dead whales. Japanese scientists say that schools may wander as far as 7 or 8 miles from such an object and then return. "If this pelagic homing does occur," Nakamura says, "it implies that the tunas have some sort of navigational system."

Birds Aid Man

Birds are most helpful to man in finding tunas. In the central Pacific, and in some other areas, fishermen rely almost wholly on sighting bird flocks to locate tuna, Nakamura points out. "They even rely on the behavior of the birds to determine certain characteristics of the schools. . . . The number and spread of the birds are indications of school size. If the birds dive and circle fast and erratically, the fish are small. If the birds are seen diving into the water, the tunas have driven their prey to the surface and are feeding actively. If the birds scatter or sit on the sea surface, the fish have sounded."

The tunas are among the swiftest fish. Their measured speeds have ranged from 0.8 to 25 meters a second (2 to 56 miles per hour).

Honolulu Lab's Program

Nakamura is interested in the behavior of tunas at sea and in the lab. His group is concentrating now on two aspects of tuna behavior: their reaction to different species of live bait, and their subsurface distribution. The largest Hawaiian fishery--for skipjack tuna--uses as bait a local-to-Hawaii anchovy called nehu. The researchers are investigating possible alternate bait species for the anchovy.

To study the location of unseen tuna, his group uses a continuous-transmission, frequency-modulated sonar aboard one of the lab's research vessels. This sonar provides data on depth, direction, and speed of tunas.

