A Japanese fisherman and his family at evening meal. His favorite dish is "Sashimi," pieces of raw fish dipped in soy sauce. His forebears for hundred of years were fishermen. (WHO Photo: T. Takahara)

INTERIOR WILL STEP UP FISH PROTEIN CONCENTRATE PROGRAM

The Department of the Interior will accelrate its fish protein concentrate (FPC) proram. The order "go" will be given shortly fter the end of a 30-day waiting period set by he Food and Drug Administration (FDA).

On February 2, 1967, FDA published in the Federal Register" proposed regulations govrning the sale of FPC as a food additive in nterstate commerce. The 30-day period ofers the public an opportunity to make valid bjections.

FPC was made from whole Atlantic red ake, a codlike fish, by scientists of the Bureau of Commercial Fisheries. It looks like a ight-tan flour and is virtually odorless and asteless. It is over 80 percent animal protein and also has several nutritional minerals. The nutritive value of 2 ounces of FPC, costing bout 3 cents, almost equals that of a 12-ounce teak costing nearly $1. About 6 pounds of fish re 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 future for hungry millions everywhere.

About 2 billion of the 3 billion people on earth, including 50-70 percent of preschool hildren, suffer from protein malnutrition. This type of malnutrition can produce mental etardation in children; even ordinary childood diseases may be fatal to them. And by he year 2000, the 3 billion people will be about billion.

Secretary of the Interior Stewart L. Udall aid that the FDA action means "that now for s little as a half-cent a day, an undernourished erson, wherever he lives, can be assured of ufficient life-sustaining animal protein. World food and health organizations have ointed to protein hunger as the most desperte human problem of the century. We now ave proved that fish protein concentrate, one ery effective answer to protein malnutrition, an be produced in laboratory-size batches. Our next step is large-scale production demonstration in pilot plants."

The Department of the Interior is authorized o build one demonstration plant and to lease another. A November 1966 law (PL 89-701) authorizes appropriations of $1 million to build one plant--and $1,555,000 annually for 5 years beginning July 1, 1967, to lease another plant, operate both the constructed and leased plants, and to conduct necessary research.

BCF scientists worked 3 years to develop the present process for making FPC. One breakthrough was the discovery that isopropyl alcohol would satisfactorily extract oil and water from the fish. This was an indispensable step toward making a stable and palatable product from an inexpensive fish.

On December 1, 1965, the National Academy of Sciences advised 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."

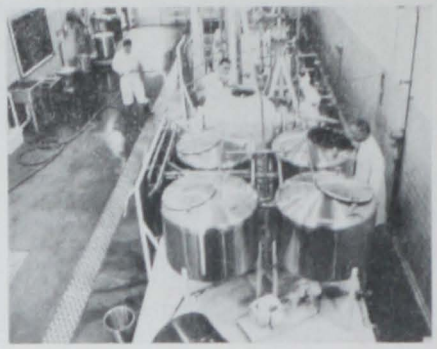
The scientists at BCF's model-scale plant in Beltsville, Md., near Washington, D. C., found that the solvent-extracted FPC blends well with other foods. It was tested successfully as an ingredient in beverages, soups, noodles, gravy, bread, and cookies; adding FPC increases their nutritive value appreciably.

The hake used to make FPC were obtained from commercial fishermen in New England, immediately packed in ice, and shipped in a refrigerated truck to Beltsville. Hake are plentiful in the Atlantic and Pacific. Other species of fish also can be used.

BCF specialists have estimated that the United States can easily harvest about 12 billion pounds of fish each year from U. S. waters--about $2\frac{1}{2}$ times the present catch. If only the fish that are not harvested now were made into FPC, they would provide the additional high-quality animal protein needed to balance the diet of 300 million people for a year at a cost of less than a half-cent per person per day.

When the ocean's underutilized resources are used to make FPC, the U. S. fishing, shipbuilding, and auxiliary industries also will gain.

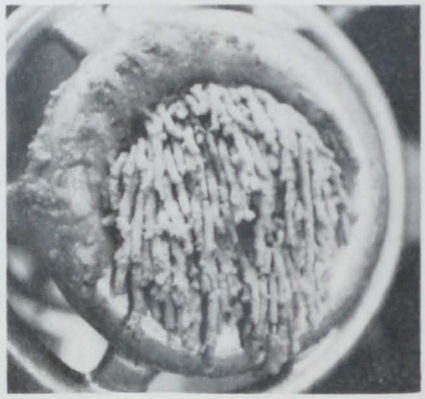
FPC is made here--in Beltsville, Md., near Washington, D. C. This is a pilot plant designed to evaluate equipment, processing methods, and to provide engineering samples.



Overall view of lab from end of the processing line. L to R: Engineering Technician Al Novinski, Chemical Engineers Herb Brecker and Bob Ernst.

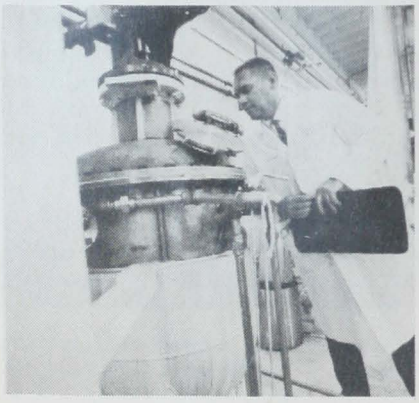
HOW FPC IS MADE

GRINDING FISH: Operator Tom Brown drops hake into grinder, which produces . . . .

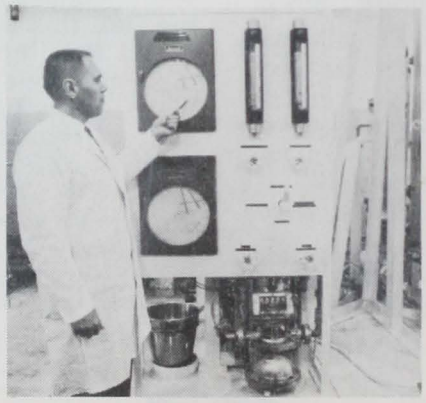


. . . . . a FISHBURGER

Fishburger is mixed with alcohol in unheated vessel to remove water and fats (they dissolve in alcohol).

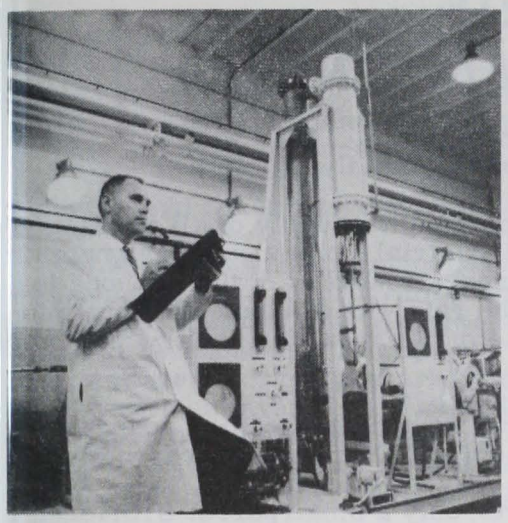


HOT ALCOHOL is used to continue the extraction of fats and moisture from the fish.

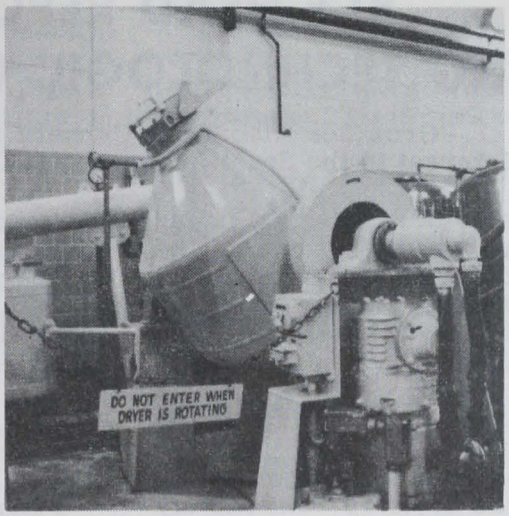


Processing of fish is conducted under carefully controlled conditions of time, temperature, and the completeness of each operation.

SEPARATION of solids, which drop into container, from liquids.



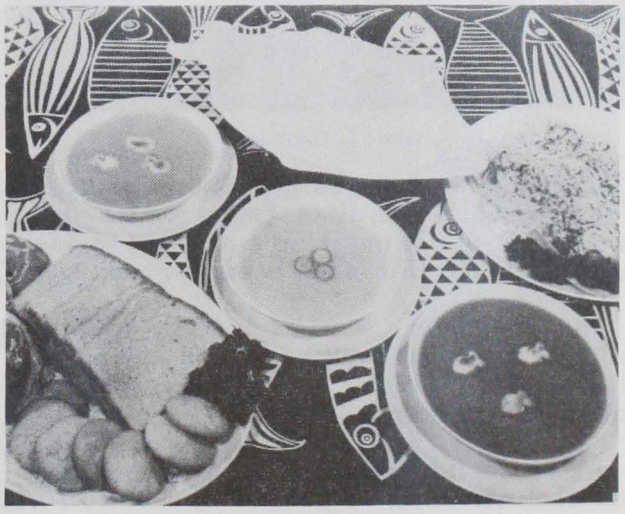
DISTILLATION COLUMN recovers alcohol, which is used again.



ROTATING VACUUM DRYER removes virtually all traces of the solvent (alcohol).

FINE GRINDER reduces fully dried FPC to particle size desired. It is bagged and marked to indicate the different experimental conditions under which it was produced.

FPC



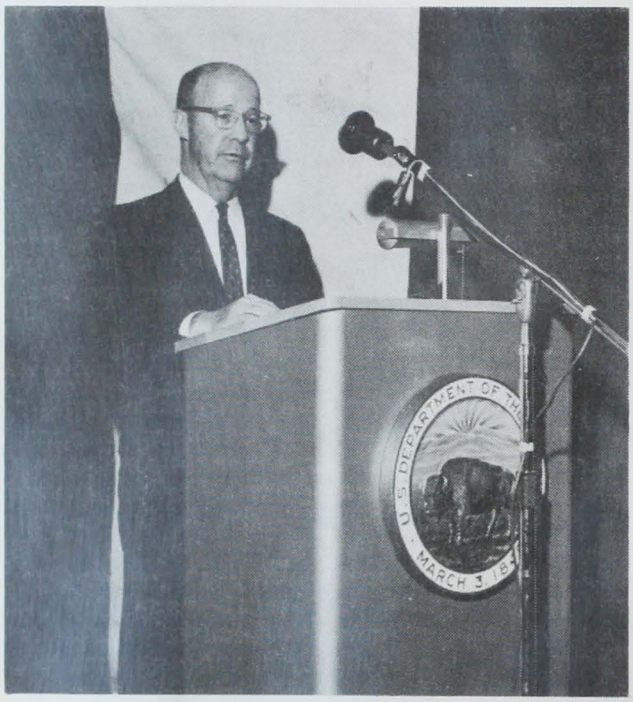
All these foods contain FPC.

BCF HEAD REPORTS STRIKING TECHNOLOGIC GAINS IN 1966

Crowther Also Tells Canners Convention
Interest in the Sea's Resources is Growing Rapidly

For several segments of the fishing industry, "1966 was a banner year," but overall the industry set few records, reported Harold E. Crowther, Acting Director, Bureau of Commercial Fisheries (BCF) to the National Canners Convention in Chicago on January 23.

But in two areas there were significant advances that portend even greater progress for the years ahead: technologic achievements by BCF scientists to aid the industry--and rapidly growing interest by Government and the public in the sea and its riches.



Harold E. Crowther.

Director Crowther said: "There is no doubt in my mind that events of last year clearly indicate that we are entering a new era of ocean science and the use of the ocean's resources."

These were the 1966 highlights presented by Director Crowther (the quotes are his):

Statistics on the Industry

• Per-capita consumption of edible products declined from 11 pounds in 1965 to 10.6. However, per-capita supply of all products--edible and industrial--on a round-weight basis was 64 pounds, a recovery of the 9 pounds lost in 1965. The gain was attributed mainly to increased use of fish meal for poultry and livestock feed.

• Imports were up 100 million pounds over 1965, primarily fish meal and frozen blocks.

• Exports, only a small part of U. S. foreign trade, reached $100 million, up slightly from 1965 and nearly double the value of $48 million in 1960.

Legislation

• One of the most important developments was passage of the Marine Resources and Development Act of 1966, which provided for 2 high-level groups to carry out its purposes. "This Act is a significant milestone in establishing the importance of ocean resources and should help coordinate the efforts of 22 different agencies conducting oceanographic research.... We now have an instrument (the 2 groups) to define effectively a national ocean policy, to specify objectives and goals of a national oceanographic program, and to recommend how our country can best achieve these goals."

Effective Use of the Sea

• In July 1966, the survey vessel "Oceanographer" of the U. S. Coast and Geodetic Survey was commissioned.

• President Johnson released the report of his Science Advisory Committee, "Use of the Sea." The report is of special interest to those in industry, fishery research, and administration "because it places emphasis on development and use of natural resources of the oceans. This is especially meaningful for the Bureau's fish protein concentrate program."

To implement the PSAC report, Secretary Udall named a top-level Interior team headed by Assistant Secretary Stanley A. Cain to "develop and coordinate Interior's many programs for developing and utilizing resources of the sea."

• The concentration of scientific, technical, legal, and engineering talent at the Second Annual Marine Technology Conference in Washington last summer showed the widespread interest in developing ocean resources.

Financial and Other Aid Programs

• There was a substantial increase in BCF's 3 financial assistance programs--vessel construction subsidy, mortgage insurance, and fisheries loan fund. But by year's end, the programs were forced to mark time until new funds were made available. "Many in industry and Government believe these 3 programs are as important as any in the Bureau and are essential to development of a modern fishing industry."

• Federal Aid. 1966 was the first full year under the Commercial Fisheries Research and Development Act, Public Law 88-309. The appropriation acts in both fiscal 1966 and 1967 made $4.1 million available to the States on a matching basis. The States responded well. "Many excellent research and development projects are now underway. PL 88-309 funds also are helping to upgrade many State fishery programs "through construction of laboratory facilities, research vessels, and employment of additional qualified personnel."

• Agency for International Development. BCF cooperated in AID's program of exporting low-cost fishery items to the Congo. In the past 8 months, AID made available $1.1 million to buy canned fishery products.

Technologic Advances

BCF made progress in testing new harvesting and preservation methods:

• Two irradiators are being used on BCF vessels "Delaware" and "Oregon" in the Northwest Atlantic and Gulf of Mexico to test this method of pasteurization at sea. Haddock, shrimp, and clams have been irradiated and now are being tested in the laboratory for odor and taste qualities. This method might permit a vessel to remain at sea twice as long and still deliver high-quality fresh fish.

• BCF scientists at the Ketchikan (Alaska) Technology Laboratory developed a method that greatly facilitates shrimp peeling with present machines.

• In the Great Lakes, where alewife fishery development is emphasized, "a project aimed at developing an electric system to guide and harvest fish is well underway."

• During the past 2 years, BCF exploratory fishing and gear development scientists have developed an electro-shrimp trawling system that is as effective during daylight hours as standard gear is during darkness (when shrimp normally are available).

• In the Pacific Northwest, Seattle-based BCF scientists developed a system featuring a large midwater trawl that stimulated the appearance of a new U. S. fishery for Pacific hake.

• Sonar. Significant progress was made in developing "a long-range, high-definition sonar for locating schools of fish and as a research tool for inventory of fishery resources."

• Space Oceanography. BCF scientists are working with the Naval Oceanographic Office and NASA "to evaluate the use of spacecraft and satellites for gathering oceanographic data." In 1966, during the last Gemini flight, the BCF research vessel "Geronimo" carried out observations in the Gulf of Mexico.

• Artificial Rearing of Mackerel and Sardines. "One of the most important scientific breakthroughs was the first successful rearing in the laboratory of Pacific mackerel and Pacific sardines from the egg to an advanced juvenile stage."

• Sea Lamprey Control. "Excellent progress continues to be made in control of the predatory sea lamprey of the Great Lakes by using chemical lampricides." In 1966, BCF biologists reported the lamprey population down 91 percent from the previous 5-year average.

• Salmon. The 4-million-case Alaskan salmon pack was the largest since 1949 and the escapement was good. "Salmon appear to be responding well to improved management practices."

Office of International Trade Promotion

BCF organized this office in 1965 to promote and demonstrate quality U. S. fishery products abroad. The office participated in

two international food trade shows in 1965 and 6 in 1966. "A conservative estimate of total sales made during the 8 fairs is in excess of $800,000."

Codex Alimentarius

The U. S. worked with 14 countries toward the development of international trading standards for fishery products through the Joint FAO/WHO Codex Alimentarius Commission.

End of Meatless Fridays

BCF is studying the effects of the end of meatless Fridays for Roman Catholics on the U. S. fishing industry.

The National Canners Convention also heard talks on legislation, the international situation, and Interior Department's responsibilities to the fishing industry from Senator Warren G. Magnuson (D., Wash.), Deputy Assistant Secretary for Fish and Wildlife and Parks, Clarence Pautzke, and Ambassador Donald L. McKernan.

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

Forecast Fewer Groundfish and Scallop on New England Banks

Various species of groundfish and sea scallops fished by New England fishermen will generally be less abundant in 1967, forecasts BCF's North Atlantic Region. The forecast is based on information provided by biologists of BCF's Woods Hole Laboratory who monitor landings of commercial fishermen and use the research vessel "Albatross IV" to study, by sampling, the populations of fish and shellfish on offshore banks.

Haddock landings in New England in 1966 were about 118 million pounds, compared with 117 million pounds in 1965. The 1966 catch was high despite fewer fish on Georges Bank. The decrease was due to natural causes and heavy foreign fishing in 1965.

The Albatross IV, research vessel of BCF. (Photo: Robert K. Brigham.)

The haddock stock there now is in a serious condition since it consists mainly of a single year class of fish--the one spawned in 1963. Albatross IV surveys showed that the 1966 year class was a poor one, as were 1965 and 1964. About 60% of U. S. landings of Georges Bank haddock in 1966 were from the 1963 year class--in the scrod-size category.

In 1967, these will grow into the large-size haddock category. The abundance of scrod haddock will decrease in 1967 and following years. Total abundance of both size categories will decrease in 1967 and probably continue to decrease through 1968 and 1969.

The haddock picture is much brighter on Browns Bank. There, the large 1962 and 1963 year classes will just be coming into the fishery in 1967, so abundance is expected to increase somewhat in 1967 and substantially in 1968.

Cod Landings Steady, Whiting Up

Cod landings in 1966 were 29 million pounds, about the same as in 1965, although there was a slight decrease in abundance. The decrease is expected to continue through 1967.

Food fish landings of whiting (silver hake) from the Gulf of Maine increased from 74 million pounds in 1965 to an estimated 81 million in 1966, due to increased fishing effort. Abundance held steady and is not expected to change in 1967.

In southern New England, where whiting are taken primarily for industrial purposes, a decrease in abundance on the inshore grounds occurred in 1966--landings dropping from 1965's 23 million pounds to 7 million pounds. This stock was heavily fished by the Soviets in 1965 and 1966. It is expected that the United States fleet in this area will continue to have difficulty finding large commercial quantities in 1967.

Ocean perch (redfish) landings decreased from 83 million pounds in 1965 to 81 million pounds in 1966. Abundance increased in the Gulf of Maine and held steady on Nova Scotian and Gulf of St. Lawrence grounds. Abundance levels are expected to continue through 1967.

Yellowtail flounder abundance has been declining recently, due to low recruitment of year classes. This is reflected in the landings: they dropped from 75 million pounds in 1965 to 65 million pounds in 1966. The decline is expected to continue through 1967.

Red Hake Abundance Dropped Sharply

Red hake is taken by the southern New England fishery for industrial purposes and by the Soviets for food. Abundance dropped sharply in 1966, probably as a result of heavy

Soviet exploitation in 1965 and early 1966. U. S. landings in 1966 were only 10 million pounds, compared with 63 million pounds in 1965. If red hake are again heavily fished by the USSR, U. S. fishermen can expect continued low abundance on their traditional grounds.

Sea scallops again were landed from both Georges Bank and Middle Atlantic grounds in 1966. Landings from Georges Bank were about 2 million pounds of meats in 1966, compared with 3 million pounds in 1965, and abundance is expected to remain about the same in 1967.

The Middle Atlantic grounds provided about 11 million pounds in 1966, about the same as in 1965. Analysis of catches shows no backlog of older scallops, so abundance in 1967 will depend largely upon the size of the newly recruited year class.

Marketing

OUTLOOK FOR EDIBLE FISHERY PRODUCTS IN 1967 AND REVIEW OF 1966

As 1967 began, supplies of edible fishery products were heavier than a year earlier. Frozen stocks of ocean perch and cod fillets, dressed whiting, fish sticks and portions, halibut, and lobster tails were relatively abundant.

In the category of canned products, salmon was plentiful. Scallops and crabs (including crab meat) were among the few popular frozen items with lower stocks than at the beginning of 1966. All in all, supplies should be ample to meet the usual upsurge in demand during the coming Lenten season.

The per-capita consumption of fishery products dipped to 10.6 pounds (edible weight) in 1966, down 0.4 pound from the 11 of 1965, but about the same as in 1962-1964. Consumption of fresh and frozen fishery products gained in 1966--at an estimated 6.2 pounds per person, it was the highest since the early 1950s. All of the decline was in canned fishery products, which dropped from 4.4 pounds in 1965 to 3.9 pounds in 1966. Consumption of cured products held at 0.5 pound per person.

There was no single factor responsible for the decline in per-capita consumption during 1966. The higher prices accompanying lower availability of canned tuna and pink salmon early in 1966 probably contributed to the decline. The effect of the change in fasting requirements of the Roman Catholic Church is under study. (Branch of Current Economic Analysis, BCF.)

December 1966 Wholesale Prices and Indexes for Edibles

Wholesale prices for edible fishery products (fresh, frozen, and canned) were up slightly in December 1966. At 125.3 percent of the 1957-59 average, the index rose 0.2 percent from November to December. This was principally because of higher prices for most items in the drawn, dressed, or whole finfish subgroup. Price increases for other items, including fresh shrimp and canned tuna, were offset by lower prices for several other products. Compared with December 1965, the overall index in December 1966 was up 5 percent because of higher prices generally for most items.

Seasonally higher prices in December 1966 for most items in the drawn, dressed, or whole

Wholesale Average Prices and Indexes for Edible Fish and Shellfish, December 1966 with Comparisons

Group, Subgroup, and Item Specification	Point of Pricing	Unit	Avg. Prices 1/ ($)		Indexes (1957-59=100)			
			Dec. 1966	Nov. 1966	Dec. 1966	Nov. 1966	Oct. 1966	Dec. 1965
ALL FISH & SHELLFISH (Fresh, Frozen, & Canned)					125.3	125.0	131.3	119.3
Fresh & Frozen Fishery Products:					126.7	126.5	136.1	120.6
Drawn, Dressed, or Whole Finfish:					123.7	121.0	136.2	123.4
Haddock, lge., offshore, drawn, fresh	Boston	lb.	.15	.15	117.1	115.2	164.0	119.6
Halibut, West., 20/80 lbs., drsd., fresh or froz.	New York	lb.	.48	.48	142.0	142.0	139.0	141.0
Salmon, king, lge. & med., drsd., fresh or froz.	New York	lb.	.88	.86	122.2	120.2	129.8	122.3
Whitefish, L. Superior, drawn, fresh	Chicago	lb.	.71	.63	105.2	93.3	91.8	93.3
Yellow pike L. Michigan & Huron, rnd., fresh	New York	lb.	.69	.65	112.9	106.4	108.9	116.2
Processed, Fresh (Fish and Shellfish):					125.7	127.6	138.1	123.5
Fillets, haddock, sml., skins on, 20-lb. tins	Boston	lb.	.40	.47	97.2	114.2	131.2	105.7
Shrimp, lge. (26-30) count, headless, fresh	New York	lb.	1.07	1.03	125.4	120.1	131.2	106.6
Oysters, shucked, standards	Norfolk	gal.	7.75	8.25	130.7	139.1	147.5	147.8
Processed, Frozen (Fish & Shellfish):					124.9	125.1	128.6	110.8
Fillets: Flounder, skinless, 1-lb. pkg.	Boston	lb.	.45	.44	114.0	110.2	109.0	101.4
Haddock, sml., skins on, 1-lb. pkg.	Boston	lb.	.39	.40	114.3	117.3	115.8	115.8
Ocean perch, lge., skins on 1-lb. pkg.	Boston	lb.	.31	.30	108.7	103.5	110.5	112.2
Shrimp, lge. (26-30 count), brown, 5-lb. pkg.	Chicago	lb.	1.11	1.11	131.0	131.0	137.5	107.9
Canned Fishery Products:					123.4	122.9	123.3	117.5
Salmon, pink, No. 1 tall (16 oz.), 48 cans/cs.	Seattle	cs.	27.00	27.50	119.9	119.9	122.0	119.8
Tuna, lt. meat, chunk, No. 1/2 tuna (6-1/2 oz.), 48 cans/cs.	Los Angeles	cs.	13.08	12.95	116.1	115.0	115.0	108.8
Mackerel, jack, Calif., No. 1 tall(15 oz.), 48 cans/cs.	Los Angeles	cs.	8.50	8.50	144.1	144.1	135.6	120.9
Sardines, Maine, keyless oil, 1/4 drawn (3-3/4 oz.), 100 cans/cs.	New York	cs.	11.25	11.25	144.3	144.3	144.3	131.5

1/ Represent average prices for one day (Monday or Tuesday) during week in which 15th of month occurs. Prices are published as indicators of movement, not necessarily absolute level. See daily Market News Service "Fishery Products Reports" for actual prices.

Source: U. S. Department of Labor, Bureau of Labor Statistics.

finfish subgroup resulted in a 2.2-percent increase from November. Wholesale prices at Chicago rose sharply for Lake Superior fresh whitefish (up 12.8 percent) because of very light supplies. At New York City, prices were up 6.1 percent for Great Lakes round yellow pike, rose 1.7 percent for frozen king salmon, but they remained unchanged for frozen western halibut. Prices for exvessel large haddock at Boston (up 1.6 percent) were higher from November to December. Compared with December 1965, the subgroup index in December 1966 was up 0.2 percent--prices were higher for whitefish (up 12.8 percent) and halibut (up 0.7 percent) but were partly offset by slightly lower prices for other items.

Shellfish Are Mixed Picture

Although December 1966 prices for South Atlantic fresh shrimp at New York City rose 4.4 percent from November, they were offset by a sharp price drop at Boston for fresh haddock fillets (down 14.9 percent). Prices also dropped for standard shucked oysters (down 6 percent) at Norfolk. These lower prices brought the processed fresh fish and shellfish subgroup index down 1.5 percent from November. Compared with December 1965, the subgroup index in December 1966 was up 1.8 percent, mainly because shrimp prices were higher (up 17.6 percent) and cancelled out lower prices for shucked oysters (down 11.4 percent) and haddock fillets (down 8 percent).

The December 1966 subgroup index for processed frozen fish and shellfish was down 0.2 percent from November. Although prices at Boston for frozen ocean perch fillets rose 5 percent and flounder fillets 3.4 percent, prices for small haddock fillets were down 2.6 percent. Frozen shrimp prices at Chicago remained unchanged from November. Compared with December 1965, the December 1966 subgroup index was 12.9 percent higher because of substantially higher shrimp prices (up 21.4 percent). Prices for flounder fillets (up 12.4 percent) were higher than a year earlier, but they were lower for ocean perch (down 3.1 percent) and haddock fillets (down 1.3 percent).

Higher prices from November to December for canned tuna (up 1 percent) were solely responsible for a 0.4 percent rise in the subgroup index for canned fishery products. Prices were unchanged for other canned fish items. Compared with December 1965, the subgroup index for December 1966 was up 5 percent. Prices were higher for all items--more substantially so for California jack mackerel (up 19.2 percent) and canned Maine sardines (up 9.7 percent). (BCF Market News Service.)

1966 Shrimp Imports Rose 8.7%

U. S. imports of shrimp (fresh, frozen, canned, and dried) for January-November 1966 were 160.8 million pounds--an increase of 8.7 percent from the 1965 period's 147.9 million. Imports from Mexico for the 1966 period were about 60.8 million pounds--up 12.9 percent from 1965's 53.8 million pounds.

The U. S. imported 20.4 million pounds of shrimp (fresh, frozen, canned, and dried) in November 1966; in November 1965, 18.5 million pounds. Imports during November 1966 of fresh or frozen heads-off shrimp (shells-on) were 15.9 million pounds; peeled and deveined, 3 million pounds; frozen breaded (raw or cooked), 82,572 pounds; and other types[1/] of shrimp products (some dried and canned) about 1.3 million pounds.

Mexico shipped about 10.5 million pounds: about 8.9 million pounds of fresh or frozen heads-off shrimp (shells-on); peeled and deveined, 1.3 million pounds; frozen breaded (raw or cooked) 82,084 pounds; other types, 169,596 pounds. In November 1965, Mexico shipped 9.6 million pounds.

1/Imports of "other types" of shrimp: peeled in airtight containers or canned (233,456 pounds); cooked but not breaded (173,870 pounds); dried (58,801 pounds); others not specified (838,513 pounds).

Salmon

DECEMBER 1966 PACIFIC CANNED STOCKS HIGHER THAN 1965

On December 1, 1966, canners' stocks (sold and unsold) in the U. S. of Pacific canned salmon totaled 3,294,606 standard cases (48 1-lb. cans)--816,548 cases above the 2,478,058 of December 1, 1965.

Of total stocks of 4,340,853 actual cases (cans of $\frac{1}{4}$-lb., $\frac{1}{2}$-lb., 1-lb., etc.)--red accounted for 2,117,218 cases (911,258 cases were 1-lb. cans and 798,015 cases were $\frac{1}{2}$-lb. cans) or 48.8 percent of the total canners' stocks on December 1, 1966; pink--1,562,139 cases or 36 percent (1,180,122 cases were 1-lb. talls); chum--316,899 cases, mostly 1-lb. talls; coho or silver--227,441 cases; and king--117,156 cases.

Total Canners' Stocks of Pacific Canned Salmon, Dec. 1, 1966

Species	Dec. 1, 1966	Nov. 1, 1966	Dec. 1, 1965
	(No. of Actual Cases)		
King	117,156	119,188	123,126
Red	2,117,218	2,246,350	1,902,932
Coho	227,441	259,476	193,729
Pink	1,562,139	1,655,427	767,120
Chum	316,899	369,069	305,471
Total	4,340,853	4,649,510	3,292,378

5 Million Cases for 1966/67 Market

Carryover stocks at the canners' level totaled 743,166 standard cases on July 1, 1966, the approximate opening of the Pacific salmon packing season. Adding the 1966 new season pack of 4,344,732 standard cases (preliminary data) the total available supply for the 1966/67 market season was 5,087,898 standard cases.

Shipments at canners' level of all salmon species, July 1 to December 1, 1966, totaled 1,793,292 standard cases. The carryover of 743,166 standard cases on July 1, 1966, the beginning of the 1966/67 sales year, was 1.3 percent higher than the carryover of 733,575 cases a year earlier.

Final data on the 1966 U. S. pack of Pacific canned salmon (including Alaska) show 4,344,732 standard cases--22.7 percent above 1965's of 3,541,187 cases. By species, the new pack was made up (1965 pack in parentheses): king, 81,626 standard cases (95,503); red, 1,441,930 cases (2,013,077); coho, 196,017 cases (170,064); pink, 2,044,479 cases (951,688); chum, 580,680 cases (310,855).

Data on canned salmon stocks are based on reports from U. S. Pacific Coast canners who handled over 96 percent of the 1966 salmon pack. (Division of Statistics and Economics, National Canners Association, Jan. 5, 1967.)

Defense Bought More Fishery Products in October-November 1966

The Department of Defense (DOD), a major buyer of fresh and frozen fishery products, bought 2.9 million pounds in November 1966, worth about $2.3 million.

In November 1966, DOD purchases rose 10.3 percent in quantity and 3 percent in value. The increase was due mainly to larger purchases of oysters, fish fillets, haddock portions, and salmon steaks.

Compared with November 1965, November 1966 purchases were up 13.4 percent in quantity and 16.2 percent in value. Average prices were generally higher in November 1966 than in 1965.

Cans Shipments for Fishery Products Steady

During January-October 1966, 2,580,702 base boxes of steel and aluminum were used to make cans shipped to fish and shellfish canning plants. During the same period in 1965, 2,539,115 base boxes were used.

Note: Statistics Cover all commercial and captive plants known to be producing metal cans. A "base box" is an area of 31,360 square inches, equivalent to 112 sheets 14" x 20" size. Tonnage figures for steel (tinplate) cans are derived by use of the factor 23.7 base boxes per short ton of steel.
Source: U. S. Department of Commerce, Bureau of the Census.

Fish Meal Supply Rose 20%, Solubles Dropped 13%

Based on domestic production and imports, the supply of fish meal available in the U. S. during the first 11 months of 1966 was 603,034 short tons--99,628 tons (or 19.8 percent) more than the 1965 period. Domestic production was 46,555 tons (20 percent) lower, but imports were 157,334 tons (60.6 percent) higher than in January-November 1965. Peru lead with shipments of 259,051 tons.

U. S. Supply of Fish Meal and Solubles, January-November 1966

Item	Jan.-Nov. 1966	Jan.-Nov. 1965	Total 1965
	. . . (Short Tons) . . .		
Fish Meal and Scrap:			
Domestic production:			
Groundfish	9,877	10,179	10,696
Herring	10,984	12,688	12,932
Menhaden 1/	128,842	169,871	175,959
Tuna and mackerel	28,259	23,124	25,399
Unclassified	8,047	16,702	17,360
Total production 2/	186,009	232,564	242,346
Imports:			
Canada	41,132	40,046	43,830
Peru	259,051	206,006	209,801
Chile	80,623	5,201	5,651
Norway	21,048	78	78
So. Africa Rep.	6,600	3,600	5,100
Other countries	8,571	4,760	6,206
Total imports	417,025	259,691	270,666
Available fish meal supply	603,034	503,406	524,717
Fish Solubles 3/:			
Domestic production	80,738	92,290	94,839
Imports:			
Canada	1,352	1,373	1,488
Peru	1,941	2,598	2,598
Mexico	385	227	227
Other countries	470	825	825
Total imports	4,148	5,023	5,138
Available fish solubles supply	84,886	97,313	99,977

1/Includes other species.
2/Does not include a small quantity of shellfish and marine animal meal and scrap because production data are not available monthly.
3/Wet weight basis except for imports from South Africa Republic (included in "other countries").
Source: U. S. Department of the Interior, BCF, and U. S. Department of Commerce, Bureau of the Census.

The U. S. supply of fish solubles was 84,886 tons--down 12.8 percent from the 1965 period. Domestic production decreased 12.5 percent, imports decreased 17.4 percent.

Over 100 Fishery Cooperatives

There are more than 100 fishery cooperatives in the United States with 10,124 members. The members owned and operated 7,514 commercial fishing boats or vessels. Over 60 percent of the cooperatives are on the Pacific Coast, and the rest are scattered. Most cooperatives do the marketing and buying for their members.

Oceanography

GULF COAST SALT DOMES MAY HAVE OTHER USES

Information on the 329 proved salt domes in the Gulf of Mexico area appears in the free Bureau of Mines publication, "Salt Domes in Texas, Louisiana, Mississippi, Alabama, and Offshore Tidelands: a Survey," Information Circular 8313. The Gulf area contains nearly all of these geological phenomena in the U. S., except for small sections of southern Utah and Colorado. The domes are important sources of rock salt, and many domes have petroleum and sulfur deposits combined with them.

Salt domes can be shaped to whatever size is desired--by dissolving salt from the formation--for inexpensive storage of natural gas. The cost of doing this is estimated at about one percent of installing steel tanks above ground.

Of the 329, four are in the Gulf off Texas and 67 off Louisiana. From 1937-1964, Louisiana domes produced 379,481,700 barrels of petroleum and condensate; one at Grand Isle also produced 1,973,000 tons of sulfur.

* * *

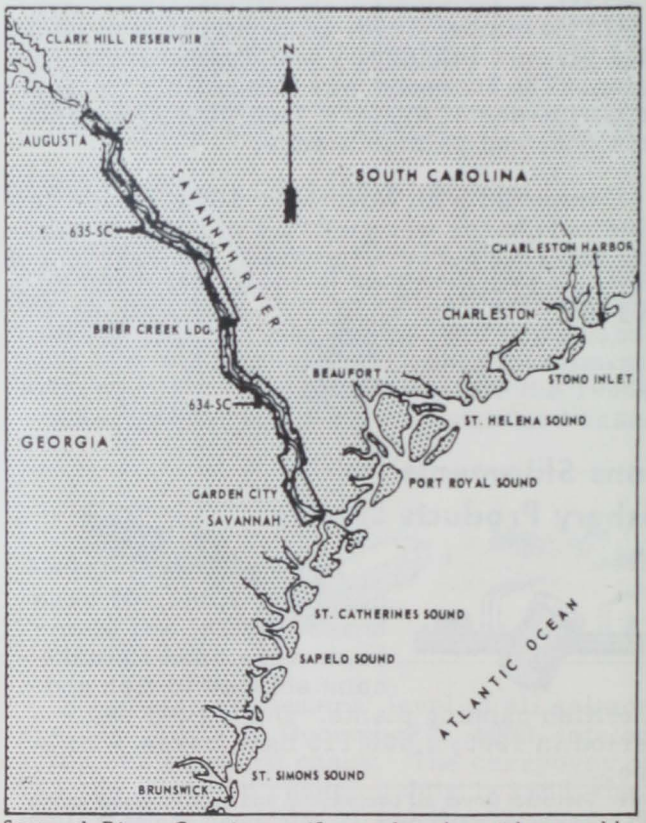
PLAN FOR PLANNED ATLANTIC SHELF SEDIMENT DATA BANK

National interest in developing the U. S. Continental Shelf for resources has prompted the Naval Oceanographic Data Center to set up an Atlantic Shelf sediment data bank. About 250 groups representing Government academic institutions and industry were asked about their holdings of data or sediment samples and their willingness to contribute data to the project. Forty percent answered.

* * *

FIRST NAUTICAL CHARTS FOR SAVANNAH RIVER CHANNEL AVAILABLE

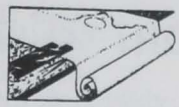
The Coast and Geodetic Survey has prepared the first nautical charts for the 180-mile-long, 9-foot Savannah River channel from Savannah to Augusta, Ga. The charts, identified as 634-SC and 635-SC, are folded small-craft charts, similar to those for the Atlantic Coast Intracoastal Waterway. They were designed for the small cockpits of pleasure craft and provide special information for them.



Savannah River, Georgia area (Savannah to Augusta) covered by new small-craft charts.

The charts are based on 1964 aerial photography by the Coast and Geodetic Survey and show the latest channel information available from the Army Corps of Engineers. Augusta is one of Georgia's 5 major ports and the improved Savannah River is an important link in the State's waterway system.

New editions of Chart 634-SC will be published annually and of 635-SC every 2 years. They can be kept timely between editions by adding corrections published in local or weekly notices to mariners. They may be bought for $1 each from nautical charts agents or from the Coast and Geodetic Survey, Washington Science Center, Rockville, Md. 20852.



SEAFOODS SAY -- POUNDS AWAY

From the quiet charm of Maryland's Eastern Shore and from the exotic Middle East come two unusual seafood dishes designed to delight the dieter.

Satisfying nourishment is the keynote in Chef's Salad Chesapeake with Lemon-Caper Dressing. Asparagus spears, nested in lettuce cups, are topped with crab meat, hard-cooked egg, and a perky, low calorie dressing to win the compliments of the weight watchers and the accolades of the hearty eaters.

CHEF'S SALAD CHESAPEAKE

1 can (12 ounces) blue crab meat or other crab meat, fresh, frozen, or pasteurized
or
2 cans (6-1/2 or 7-1/2 ounces each) crab meat
1 package (10 ounces) frozen asparagus spears
6 lettuce cups
Lemon-Caper Dressing
3 hard-cooked eggs, sliced
Paprika

Thaw frozen crab meat. Drain crab meat. Remove any remaining shell or cartilage. Flake the crab meat. Cook asparagus spears according to directions on package. Drain and chill. Place 3 asparagus spears in each lettuce cup. Place about $\frac{1}{3}$ cup crab meat on asparagus. Cover with approximately 2 tablespoons Lemon-Caper Dressing. Top with 3 slices hard-cooked egg. Sprinkle with paprika. Serves 6. Approximately 130 calories in each serving.

LEMON-CAPER DRESSING

1/2 cup low calorie salad dressing (mayonnaise type)
1 tablespoon drained capers
1 tablespoon lemon juice
1/2 teaspoon prepared mustard
1/2 teaspoon Worcestershire sauce
2 drops liquid hot pepper sauce

Combine all ingredients. Chill. Makes approximately $\frac{2}{3}$ cup salad dressing.

Chef's Salad Chesapeake and Cod Curry are meals with minimal calories, maximum flavor and eye appeal which are easy to prepare.

Cod Curry is an easy exotic, as meaty cod fillets blend with a colorful combination of readily available kitchen staples. The subtle hint of curry excites taste buds in this high protein entree while vegetables and skim milk add only a few calories to the showy sauce.

COD CURRY

2 pounds cod fillets or other fish fillets, fresh or frozen
1 cup thinly sliced celery
1 cup thinly sliced onion
1 tablespoon melted fat or oil
1 teaspoon curry powder
1 teaspoon salt
Dash pepper
3/4 cup skim milk
Paprika

Thaw frozen fillets. Skin fillets and place in a single layer in a greased baking dish, 12 x 8 x 2 inches. Cook the celery and onion in fat for 5 minutes. Stir in seasonings and milk. Spread over fish. Bake in a moderate oven, 350° F., for 25 to 30 minutes or until fish flakes easily when tested with a fork. Sprinkle with paprika. Serves 6. Approximately 140 calories in each serving.

Meals with minimal calories, maximum flavor, and eye-appeal aren't the easiest thing in the world to come by. However, even company dinners that meet these requirements come easy if you consider all that fish and shellfish have to offer. To help you with your planning, the United States Department of the Interior's Bureau of Commercial Fisheries has released a new, 16 page, full-color, diet booklet, Seafood Slimmers, which is available by sending 25¢ to the Superintendent of Documents, Washington, D. C. 20240.

STATES

Alaska

FISHERY PRODUCTS ARE MOST VALUABLE IN ITS 100TH YEAR

In the centennial year of its purchase from Russia for $7.2 million, the value of Alaska's processed fishery products is over $125 million a year, twice the next most valuable industry--forest products worth $58 million.

Oregon

UMATILLA INDIANS SEEK TO ESTABLISH COHO SALMON RUN

A campaign to restore coho (silver) salmon in the Umatilla River of Northeastern Oregon has been launched by Oregon State and Federal agencies in cooperation with the Umatilla Confederated Indian Tribes. Coho runs flourished in this stream before the development of the region destroyed them.

A major step in the program was taken with the planting of 500,000 coho eggs on the Umatilla Indian Reservation about 12 miles east of Pendleton, Oregon. The eggs were planted in wooden incubation boxes designed by BCF and installed in special facilities constructed by the Indians in fall 1966.

Officials of the U. S. Fish and Wildlife Service hope that many of the half-million eggs will hatch into baby salmon in about a month; then, after living in the river for about a year, will make the long journey to the Pacific Ocean via the Columbia River. Those that survive the rigorous trip and the sea's perils will return to the Umatilla River 2 or 3 years later to spawn--reestablishing the coho runs.

North Carolina

CALICO SCALLOP FISHERY THRIVES

For the past few months, 7 to 10 vessels have been landing daily 500-600 bushels per vessel of calico scallops in Morehead City, N. C. The vessels normally operate 5 days per week and most of the catch is processed by 2 shucking plants. The weekly production is about 300,000 pounds (pints) of meats.

Several factors aided the development of this fishery: BCF's exploratory operations delineated the resource; its technical assistance familiarized local fishermen with scallop dragging techniques; State and local interests combined to promote use of this resource.

Washington

PUGET SOUND HAKE FISHERY SHOWS PROMISE

From the season's start in late October 1966 through mid-January 1967, 2 million pounds of hake were landed in the Saratoga Passage-Port Susan area of the Sound. Most of the fish were landed by one vessel using midwater trawls. Later, 3 more trawlers joined the fishery.

BCF's Seattle-based gear specialists have provided technical assistance to these vessels in the design and use of midwater trawls, and in installing depth telemetry systems. The fishery normally lasts until June and is expected to surpass last year's $6\frac{1}{4}$ million pounds.

Virginia

FOSSIL OYSTERS FOUND ON CONTINENTAL SHELF

A clump of large oyster shells was seined from the bottom in 90 feet of water, several miles off Chincoteague, by Captain Herbert Freeman of the "Elsie Jane" working out of Hampton, Virginia. According to Dr. J. D. Andrews, Virginia Institute of Marine Science, these are shells of Virginia oysters--but oysters do not grow in water deeper than 50 feet, nor offshore in the open ocean.

There are indications that about 10,000 years ago many lagoons and estuaries existed over the present continental shelf. Many fossil oyster shells have been collected from shelf waters along the Atlantic coast. Radiocarbon techniques indicate that these oysters were alive about 9-11,000 years ago.

BUREAU OF COMMERCIAL FISHERIES PROGRAMS

It sought "ground truth" for Gemini XII's photography

CRUISE "DELTA I" OF THE "GERONIMO"

By Reed S. Armstrong, John R. Grady, and Robert E. Stevenson*

On November 8, 1966, the R/V "Geronimo" sailed from Galveston, Tex., for the Mississippi River Delta to acquire oceanographic information on the sparsely sampled Delta area and to obtain "ground truth" for the photography of the Gemini XII manned space-

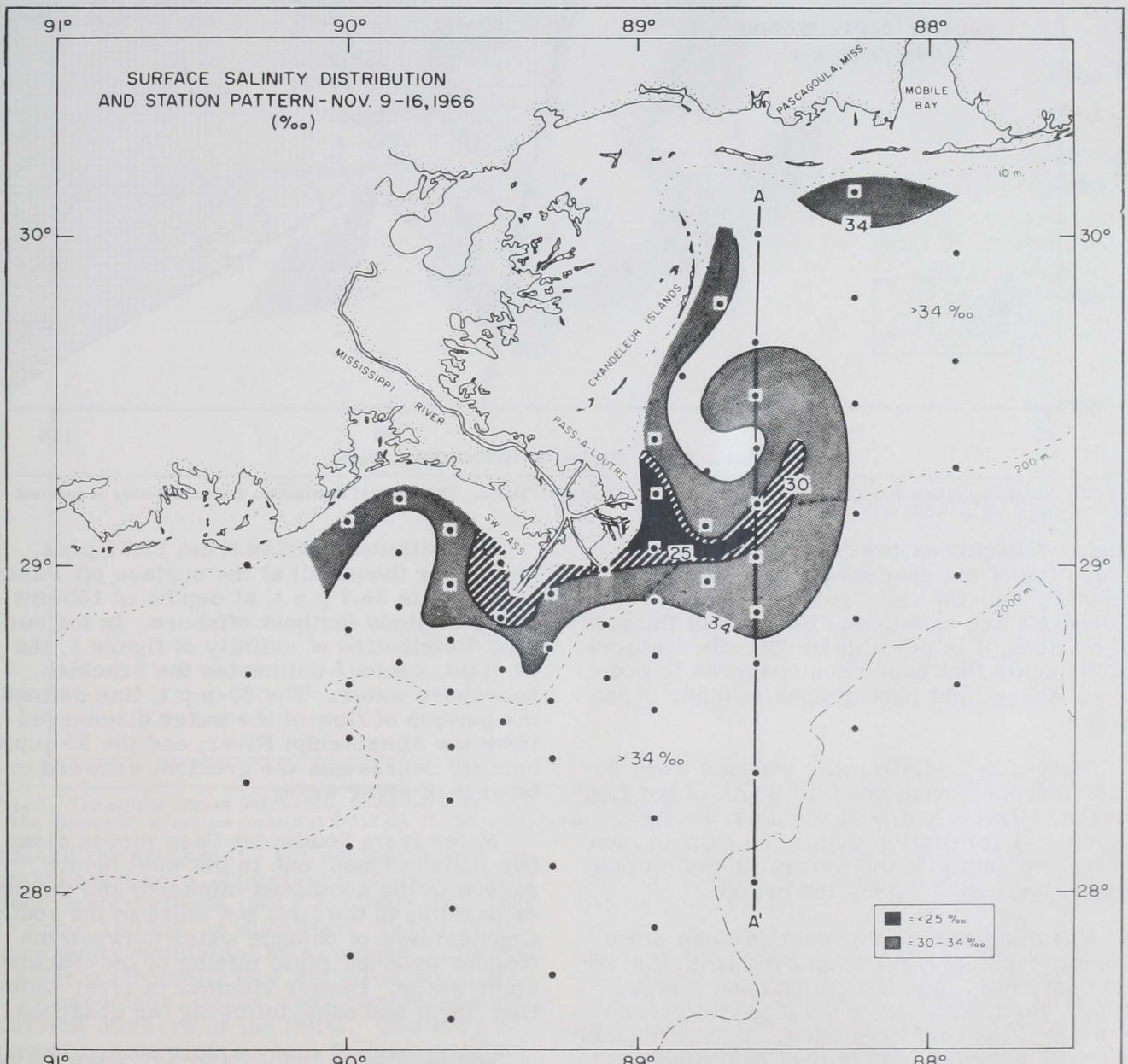


Fig. 1 - The surface salinity distribution around the Mississippi Delta, November 9-16, 1966. Note the eddy northeast of the Delta.

*Research Oceanographers, BCF Biological Laboratory, Galveston, Texas.

Note: Contribution No. 231, Bureau of Commercial Fisheries Biological Laboratory, Galveston, Tex.

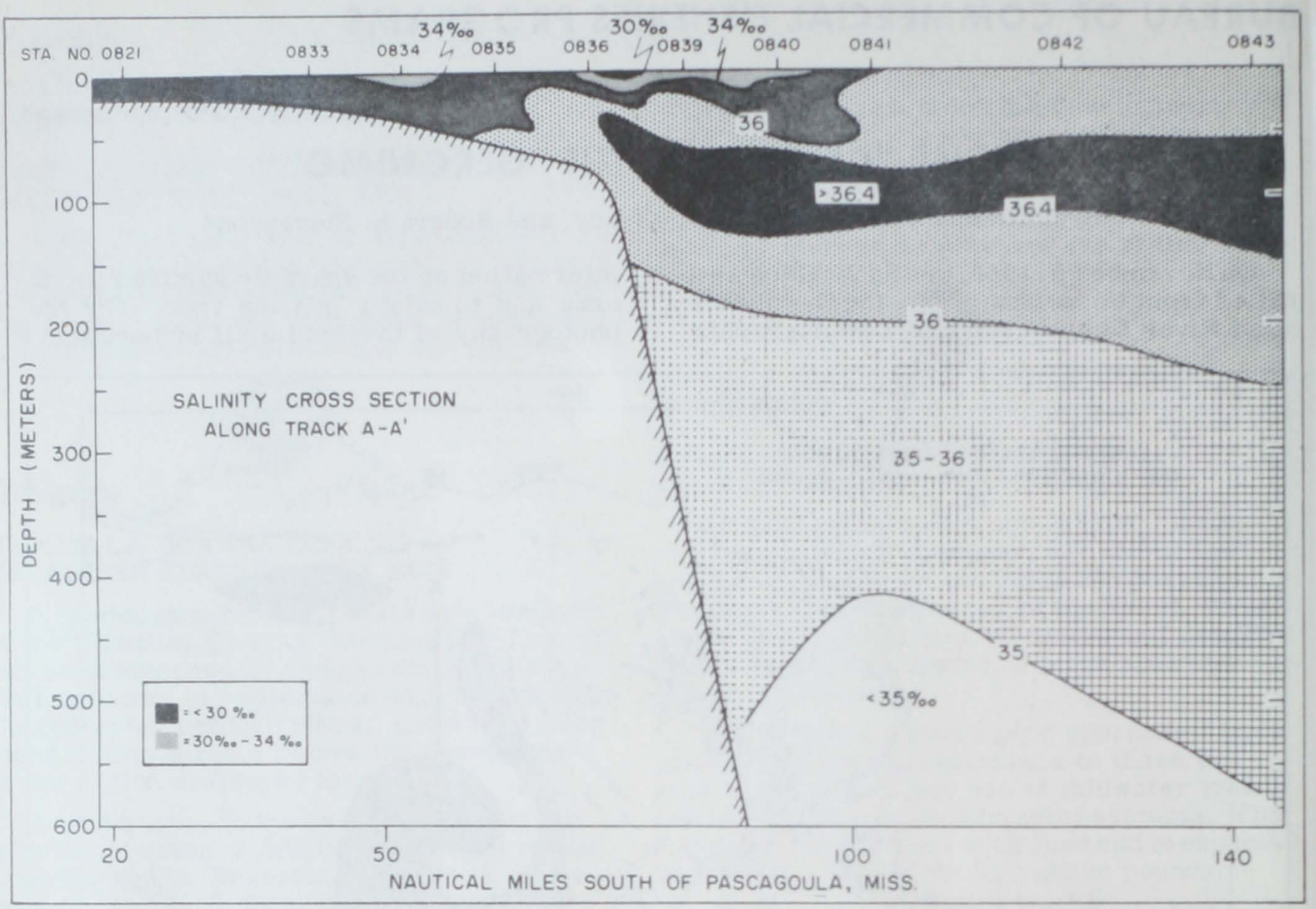


Fig. 2 - A salinity section through the eddy northeast of the Mississippi Delta. The vertical distribution around the eddy is apparent in the waters off the edge of the shelf.

flight. Cloudiness over the Delta prevented execution of the spacecraft's photographic mission, but the data gathered from the Geronimo are excellent. Because of the grid of stations, it is possible to describe features of the scale that have been observed in previous spaceflight photographs of other ocean areas.

Sixty-nine hydrographic stations were occupied from November 9-17 south of the Louisiana, Mississippi, and Alabama coasts. (See fig. 1 for station plan.) To gain an idea of the continuity in the waters, nine stations were reoccupied during the cruise.

The distribution of properties was more complex than has been reported from historical data (e.g., see Drummond and Austin, 1958, "Some aspects of the physical oceanography of the Gulf of Mexico," U. S. Fish and Wildlife Service), and is best exhibited from the salinity and oxygen content.

The salinities varied from 13.01 p.p.t. (parts per thousand) at the surface off Pass-a-Loutre to 36.7 p.p.t. at depths of 150 m. at the stations farthest offshore. In the surface distribution of salinity of figure 1, the 34-p.p.t. contour delineates the brackish, nearshore water. The 30-p.p.t. line defines the pattern of flow of the water discharged from the Mississippi River; and the 25-p.p.t. contour represents the greatest seaward extension of river water.

Water from Southwest Pass moves along two main tongues, one to the west (which curves to the southwest offshore) and the other parallel to the first but more to the south. Counterflows of oceanic water between the tongues produce rapid mixing of the brackish river water. Lesser volumes of river water flow north and east, following the coastline.

The discharge from Pass-a-Loutre splits into two flows, one to the north and the other

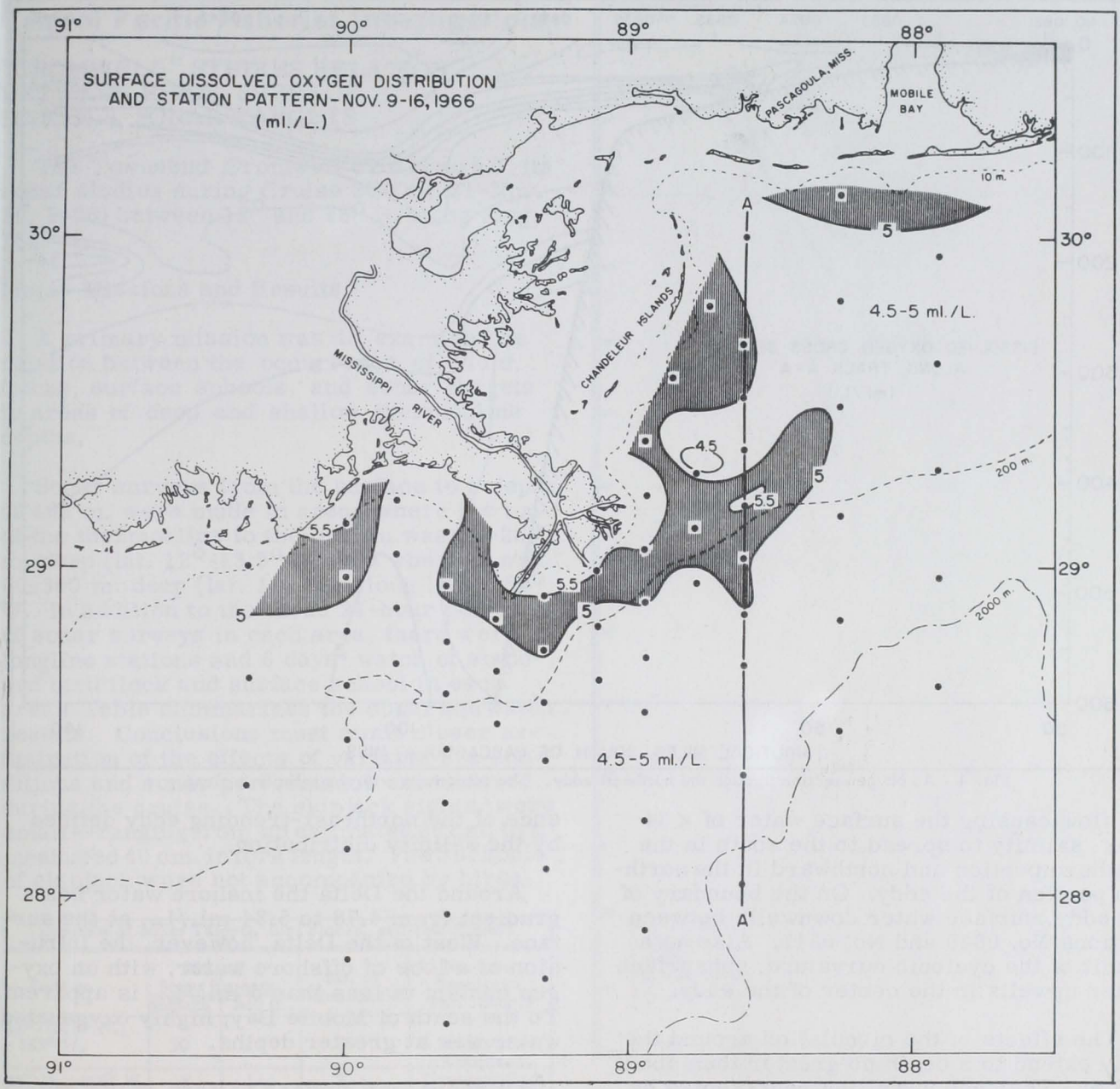


Fig. 3 - The surface oxygen distribution, November 9-16, 1966. The conformity with the salinity and the river discharge is clear. The waters with an oxygen content of 5-5.5 ml./L. are indicated by shading.

toward the southeast. The northerly flow remains nearshore. The river water that moves southeasterly feeds into a cyclonic eddy that is about 150 km. in diameter. This eddy is apparently maintained by a current that moves westerly off Mobile Bay and turns south off the Chandeleur Islands, and by a northeasterly current offshore of the Delta. The eddy is probably a semipermanent feature as these currents are at least semiprevailing circulations.

The salinity cross-section of figure 2 depicts additional features of the waters around the area of the eddy. As in figure 1, the water of <30 p.p.t. represents the river discharge; the areas of <34 p.p.t. represent the nearshore water and regions of >34 p.p.t indicate the oceanic waters. The eddy in this section is contained between stations No. 0833 and No. 0841 and the center is at about station No. 0835. Because of the cyclonic curvature, the surface water is drawn to the outside of

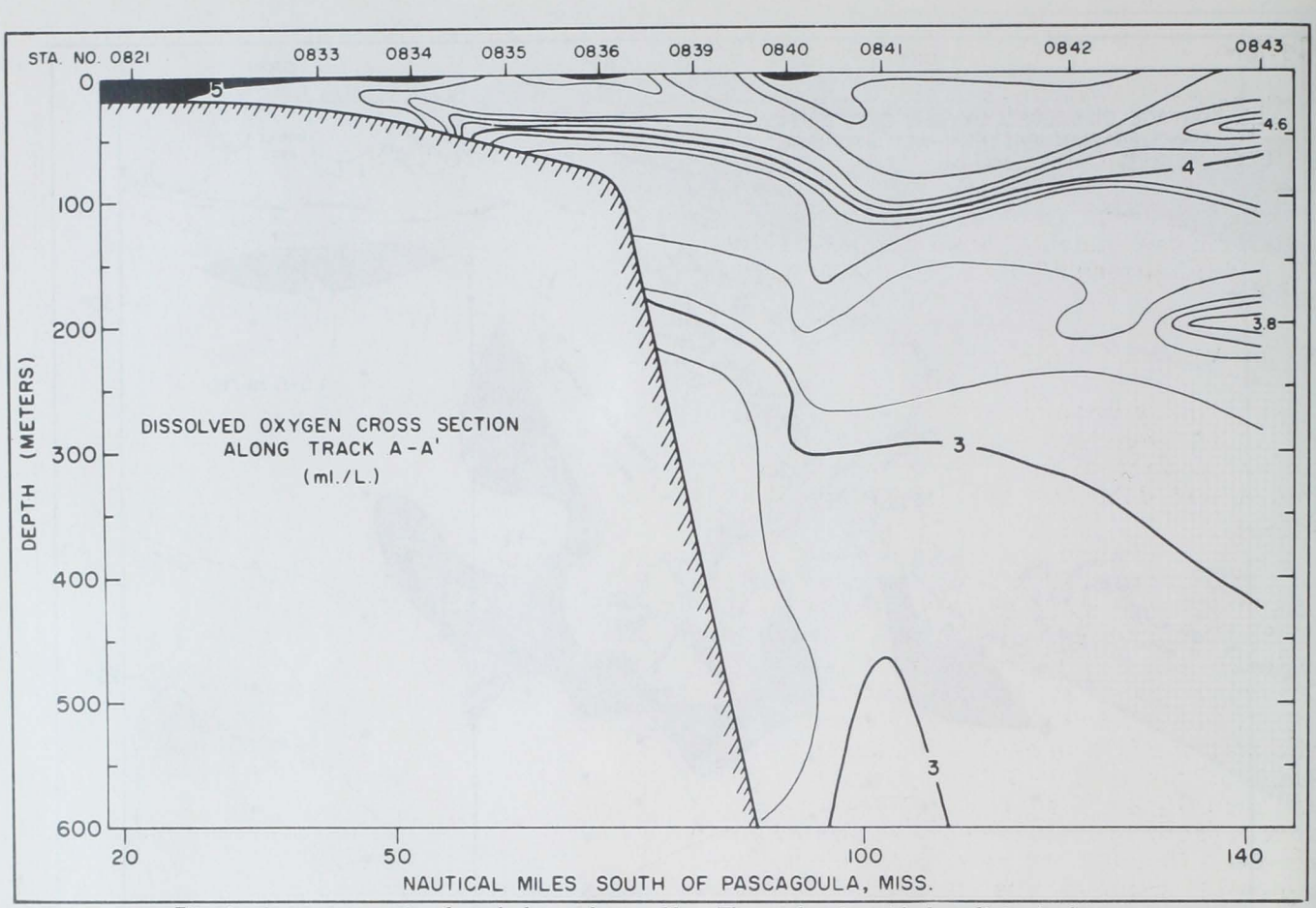


Fig. 4 - An oxygen section through the northeast eddy. The conformity with the salinity is clear.

the flow causing the surface water of <34 p.p.t. salinity to spread to the south in the southern portion and northward in the northern portion of the eddy. On the boundary of the eddy, surface water downwells between stations No. 0840 and No. 0841. Also as a result of the cyclonic curvature, subsurface water upwells in the center of the eddy.

The effects of the circulation around the eddy extend to a depth no greater than about 225 m. The deep upwelling represented by the rising 35-p.p.t. contour is probably associated with the offshore northeasterly current.

The distribution of dissolved oxygen (fig. 3) off the Delta distinctly reflects the presence of the northeast-trending eddy defined by the salinity distribution.

Around the Delta the inshore water has a gradient from 4.78 to 5.84 ml./L., at the surface. West of the Delta, however, the intrusion of a lobe of offshore water, with an oxygen content of less than 5 ml./L., is apparent. To the south of Mobile Bay, highly oxygenated water was at greater depths.

Offshore, the surface pattern of the oxygen distribution is broken by upwelling of water of lower oxygen content associated with the eddy (fig. 4). The area east of the Delta where the surface oxygen values are >5.00 ml./L. appears to coincide with the axis of the eddy.

Central Pacific Fisheries Investigations

"CROMWELL" STUDIES RELATION BETWEEN BIRDS, SURFACE SCHOOLS, SONAR TARGETS

The Townsend Cromwell continued its sonar studies during Cruise 28 (Oct. 21-Nov. 16, 1966) between 12° and 18° N. along long. 155° W.

Major Missions and Results

A primary mission was to examine the relation between the occurrence of bird flocks, surface schools, and sonar targets in areas of deep and shallow thermocline depths.

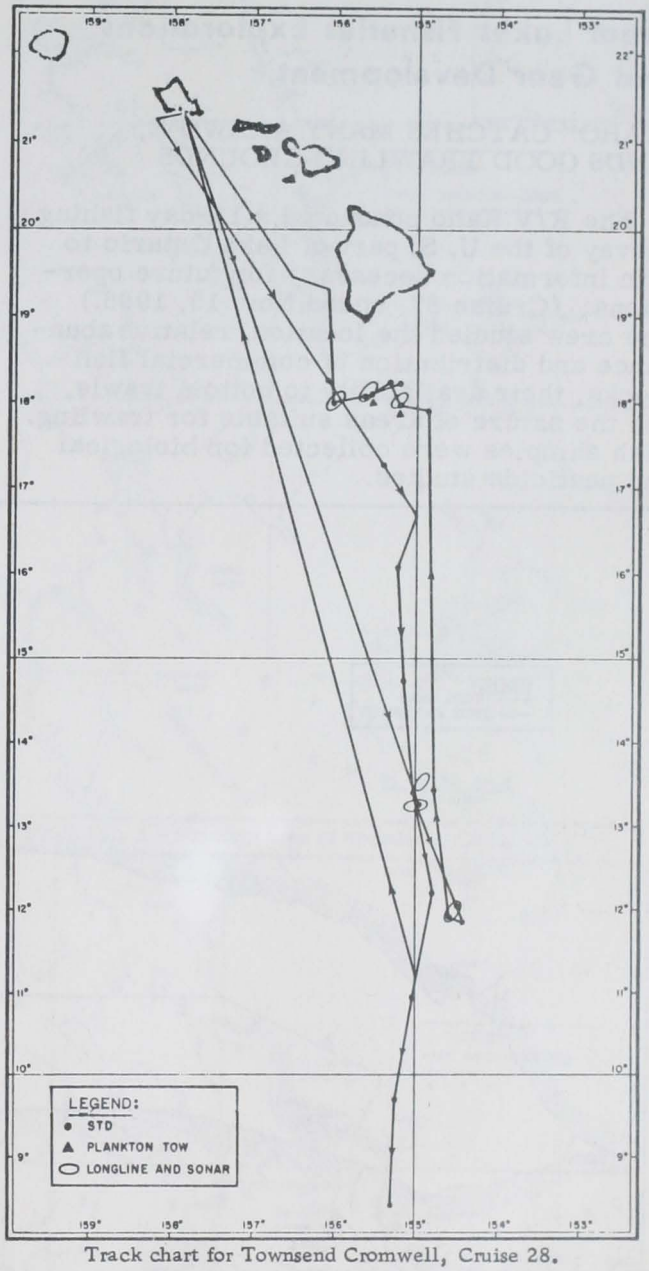
Sonar surveys from the surface to a depth of 400 m. were made in areas where the top of the thermocline to the bottom was 30-200 m. deep (lat. 12°-13.5° N.) and where it was 60-300 m. deep (lat. 18° N.) along long. 155° W. In addition to the three 24-hour periods of sonar surveys in each area, there were 3 longline stations and 6 days' watch of standard bird flock and surface school in each area. Table summarizes the sonar and watch results. Conclusions must await closer examination of the effects of variable sea conditions and sonar performance encountered during the cruise. The skipjack sighted were small--ranging from an estimated 25 cm. to a measured 40 cm. in fork length. The 3 schools of skipjack were not accompanied by birds.

Numbers of Sonar Targets, Bird Flocks, and Fish Schools

Position	No. of Sonar Targets		No. of Bird Flocks	No. and Species of Fish Schools
	Surface	>10 m.		
12°-13.5° N., 155° W.	10	31	5	5 unidentified, 3 skipjack.
18° N., 155° W.	8	14	2	2 unidentified.

Another mission of the cruise was to examine the relation between depth of targets located by sonar and the temperature, light, and salinity profiles of the environment.

STD casts to 500 m. were made at the beginning of each sonar survey and after each setting of the longline. Strong winds and changing light conditions precluded the successful use of the irradiance meter. In the shallow thermocline area, the 31 nonsurface targets (>10 m. deep) were distributed irregularly in depth, but they were found at almost all depths down to 284 m. The most noticeable gap in distribution was between 130 and 160 m. and generally coincided with the depth of the salinity minimum. In the deep thermocline area, 11 of the 14 nonsurface targets were at 90-160 m., 2 at 20-40 m., and 1 at 240-250 m.



Track chart for Townsend Cromwell, Cruise 28.

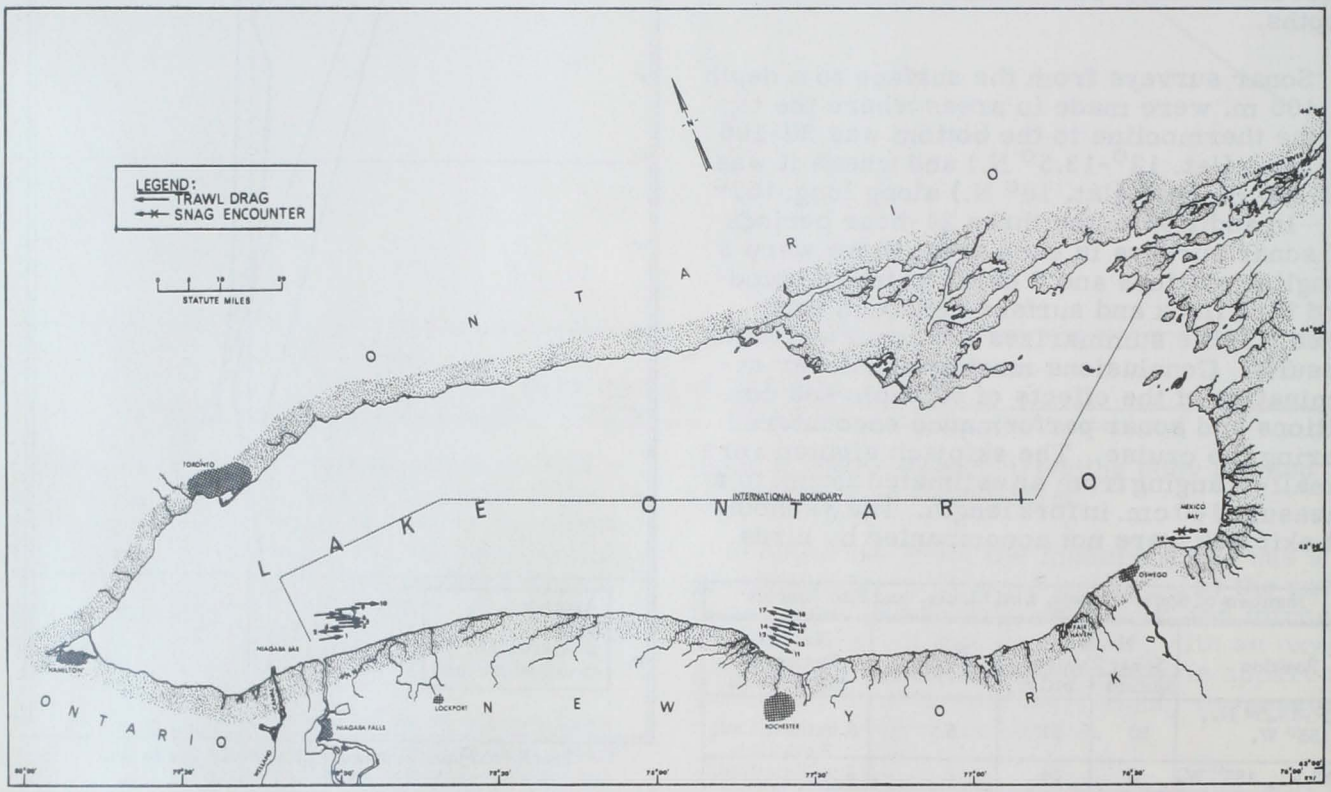
The Cromwell also collected temperature and salinity data to and from operation area and recorded and transmitted routine BT and weather information.

Note: For more information, contact Area Director, Bureau of Commercial Fisheries, P.O. Box 3830, Honolulu, Hawaii 96812.

Great Lakes Fisheries Explorations and Gear Development

"KAHO" CATCHES MANY ALEWIFE, FINDS GOOD TRAWLING GROUNDS

The R/V Kaho conducted a 15-day fishing survey of the U. S. part of Lake Ontario to gain information necessary for future operations. (Cruise 37, ended Nov. 15, 1966.) The crew studied the location, relative abundance and distribution of commercial fish stocks, their availability to bottom trawls, and the nature of areas suitable for trawling. Fish samples were collected for biological and pesticide studies.



Lake Ontario explorations, R/V Kaho Cruise 37.

Highlights: (1) Large catches, almost all alewife, as large or larger than those in Lake Michigan during this time of year. (The 1966 forecast for the new Lake Michigan alewife fishery was for over 30 million pounds.) (2) Ideal bottom trawling grounds extending from 10 to 50 fathoms along most of Lake Ontario's south shore. Exceptionally good trawling grounds were found minutes away from Youngstown, N. Y. (Niagara Bar) and Rochester, N. Y. Continuous echo-sounder recordings revealed extensive and widely distributed schools from one end of U. S. part to the other.

Fishing Results: Total production was 8,539 pounds--97.6 percent alewife and 2.3 percent smelt--taken in only 9 hours and 50 minutes of fishing time. Other species amounted to only 7 pounds. Commercially significant catches of alewife of 700,440 and 900 pounds per drag were taken off Niagara Bar at 20, 25, and 45 fathoms, respectively. Off Rochester, 4 drags produced 630 to 1,500 pounds of alewife (average 1,158 pounds) at 15 to 30 fathoms. The best catches of smelt (40 and 30 pounds) off Rochester were taken at 15 and 20 fathoms.

Hydrographic Data: Bottom (fishing) temperatures ranged from 41° F. to 43° F., surface temperatures ranged from 44 to 46 degrees.

Note: For more information, contact Bast Director, Exploratory Fishing Base, BCF, 5 Research Drive, Ann Arbor, Mich. 48103.

Alaska Fisheries Explorations and Gear Development

"MANNING" CONDUCTS SHRIMP SURVEY OFF SOUTHEAST ALASKA

The M/V John R. Manning returned to Juneau December 16, 1966, after a 6-week exploratory shrimp survey in the Icy Strait and Ernest Sound areas of southeast Alaska (Cruise 66-4).

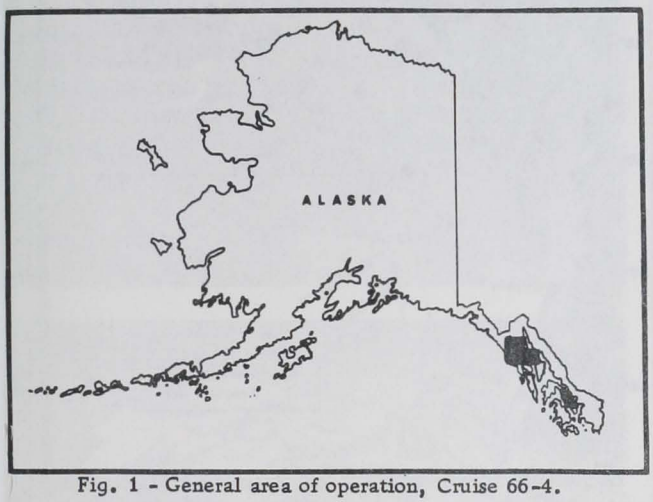


Fig. 1 - General area of operation, Cruise 66-4.

Principal cruise objectives: (1) to locate commercial concentrations of the larger pandalid species, spot shrimp (Pandalus platyceros) and coonstripe shrimp (P. hypsionotus), and (2) to test the relative fishing efficiencies of 6 types of shrimp pots. Secondary objectives: to gain information on the catching efficiency of tickler chain-rigged and roller gear-rigged shrimp trawls.

Best catches of shrimp in the northern area (see figure 2) were made in Charpentier Inlet, Glacier Bay, where 15 strings set between the 47 and 84 fathom depth contours produced 240 pounds of coonstripe shrimp. These shrimp averaged 19.85, and ranged from 15 to 28 whole shrimp per pound.

Four drags were made with the 40-foot shrimp trawl, 3 with the tickler chain-rig, and one with the roller-rig. A significant reduction in numbers of crabs, miscellaneous invertebrates, rocks, and other debris occurred in the set with the roller-rigged trawl.

In general, commercially significant quantities of shrimp were not located in the northern area of operations.

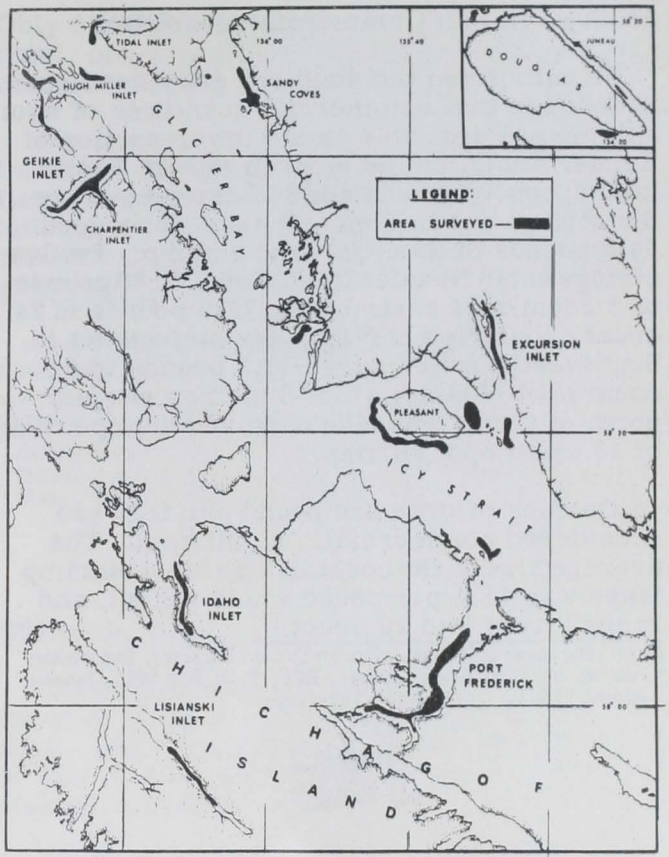


Fig. 2 - Northern area of operation, Cruise 66-4.

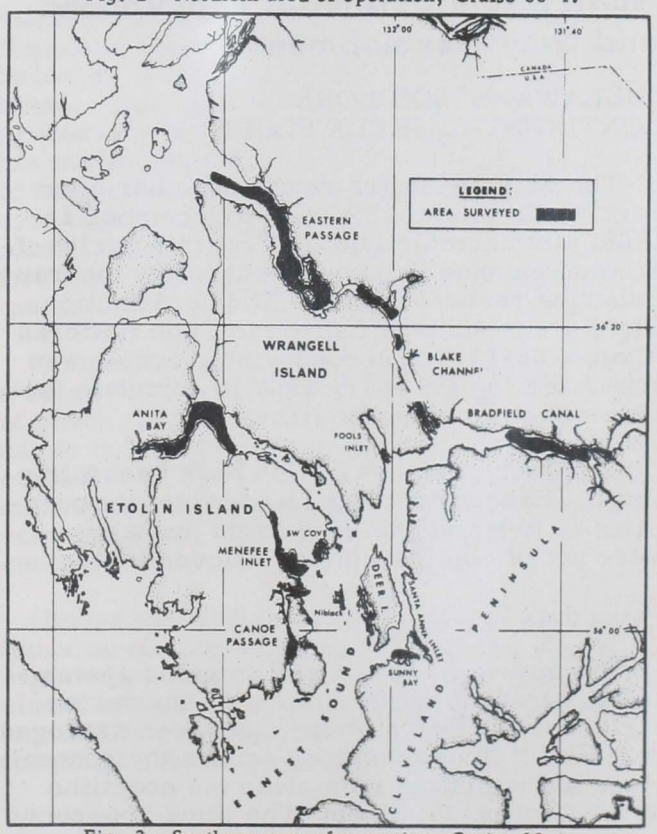


Fig. 3 - Southern area of operation, Cruise 66-4.

South Area Has Commercial Quantities

Results from the southern area (see figure 3) indicate that commercial quantities of spot shrimp are available in the lower section of Ernest Sound, on the eastern side of Etolin Island, between the 22 and 84 fathom contours. Six strings set in Canoe Passage produced 64.8 pounds of 20 count spot shrimp. Twelve strings set in Nenefee Inlet produced 65 pounds of 8 count spot shrimp, and 19.2 pounds of 24 count coonstripe shrimp. Six strings set in Southwest Cove captured 97.3 pounds of 9 count spot shrimp, while 6 strings set just north of Canoe Passage captured 40.4 pounds of 13 count spot shrimp.

Catches of over one pound per trap are considered commercially significant. The average size of the cocktail size (spot) shrimp taken was 11.4 per pound whole weight, and ranged from 4 to 20 count.

Note: For more information, contact Base Director, Exploratory Fishing and Gear Research Base, BCF, P.O. Box 1668, Juneau, Alaska 99801. Telephone: 586-7233.

North Atlantic Fisheries Explorations and Gear Development

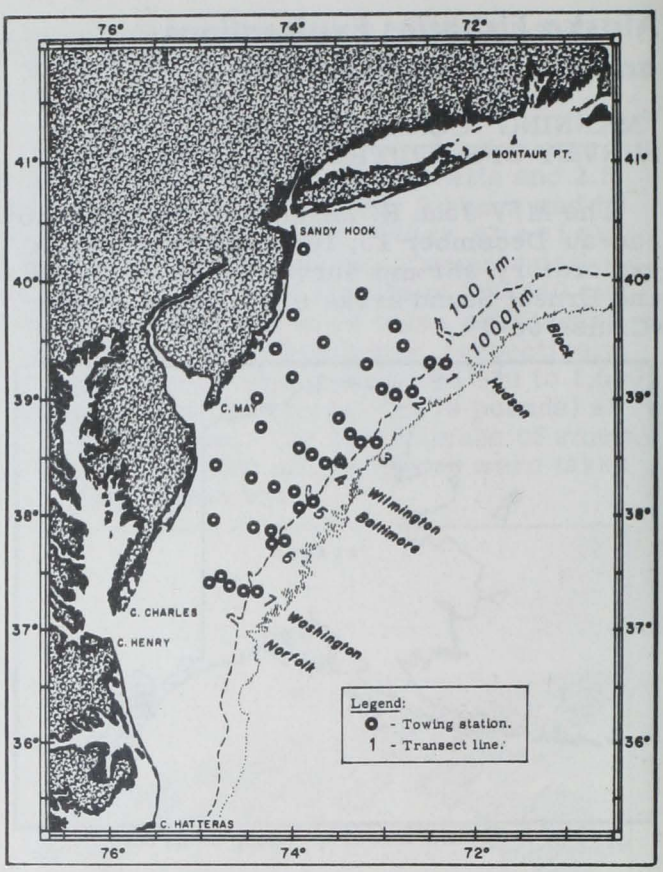
"DELAWARE" EXPLORES CONTINENTAL SHELF SLOPE

The M/V Delaware returned to her home port of Gloucester, Mass., on December 15, 1966, after completing the first in a series of cruises planned to survey seasonally the trawl fisheries resources of the Middle Atlantic Bight area--Hudson Canyon to Cape Hatteras (Cruise 66-11). A second winter cruise was scheduled for February 1967 to complete the area not covered in the first.

Generally, catches of fish have been fairly small. Except for scup and lobster, the quantities of fish and shellfish found probably were not of commercial significance.

Procedure

The survey area is to be sampled systematically by fishing the same stations during each season. The stations have been arranged in transect lines extending across the general slope of the bottom from near the coastline to the Continental Slope. The lines are spaced



Survey area of M/V Delaware Cruise 66-11.

about equally and, generally, about perpendicular to the coast. There are 12 transect lines between the western side of Hudson Canyon and the offing of Cape Hatteras.

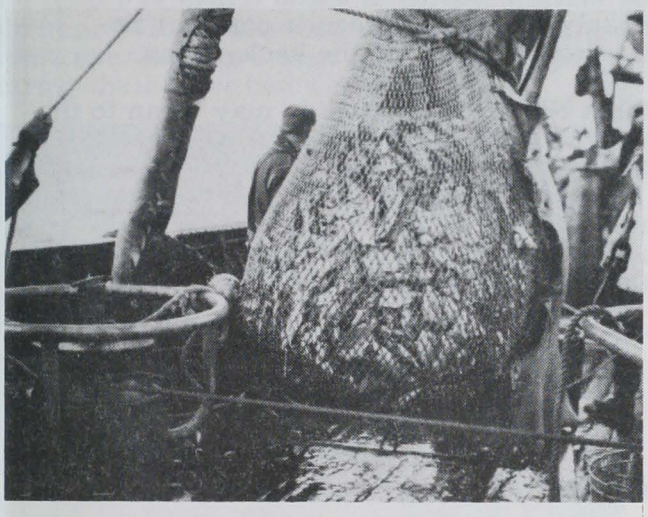
Fishing stations are positioned along the transect lines at depths of 10, 20, 35, 50, 75, 100, 250, 400, 600 (and possibly 800) fathoms. However, minor changes in positions (and transect lines too) are required sometimes because of known wrecks, hard bottom telephone cables, submarine transit lanes, etc.

Commercial style fishing gear is used: roller rigged, nylon, #41 "Yankee Trawl" nets (70-foot headrope, 100-foot footrope) with suitable size, commercial type, bracket hung doors (10' 6" length).

Results

During cruise 66-11, 42 stations were fished--40 at planned sampling stations, 2 in unscheduled depths or positions. The crew fished all planned stations on the Continental Shelf between 10 and 100 fathoms, inclusive, lying between Hudson Canyon and the offing of Wachapreague Inlet Buoy, about 35 miles northeast of Cape Charles--except for two

10-fathom stations at transects 6 and 7. The area covered is about two-thirds of the Shelf area to be surveyed; the February cruise is scheduled to fish all Slope stations.



An inshore catch before and after emptying into checker.

Although many of the scup (Stenotomus versicolor) were of maximum size, the amount taken probably would not sustain commercial fishing except for draggers with smaller crews. Several commercial fishing vessels were observed trawling near the Delaware's best scup catches.

Lobsters (Homarus americans) occurred in 30 of the 32 catches taken from 35 fathoms or more. However, the best quantities were taken in 100 fathoms. The largest catch was 5 bushels, weighed 190 pounds, and was taken on a 1-hour tow (position: 1H4-4188; 1H5-2690). Only 6 berried females were in it. In contrast, one 4-bushel catch taken at 75 fathoms contained 38 egg-bearing females.

Squid were the most prevalent species found and occurred in all except 2 catches. Largest was 8 bushels from 1-hour tow at 75 fathoms. Two species were mixed in catches: common (Loligo pealii) and sea arrows (Ommastrephes illecebrosa).

Dogfish (Squalus acanthias) were most abundant in about 35 fathoms or less, but were taken to depths of 100 fathoms.

Note: For further information, contact Dr. John R. Thompson, Acting Base Director, or Ernest D. McRae Jr., Exploratory Fishing and Gear Research Base, State Fish Pier, Gloucester, Mass., 01930, Telephone: 617-283-6554.

What A Tuna Can See

A skipjack tuna can distinguish an object the size of a pinpoint 2 feet away from its nose. Other fishes that live in the upper levels of the ocean also are remarkably sharp-sighted, scientists are finding.

For several years, Eugene L. Nakamura, biologist at BCF's Biological Laboratory, Honolulu, has been studying the vision and behavior of the commercially important tunas. The laboratory has conducted other processing investigations in this field. Using his techniques, the Laboratory has been able to keep tunas alive for research in its shoreside tanks for months on end. It is the only place in the world where these large and active fish are regularly available for experiment.

The skipjack tuna (Katsuwonus pelamis), a relatively small and very plentiful fish, is of particular interest to the Laboratory because it forms the mainstay of Hawaii's chief commercial fishery. Also, several studies conducted by the Laboratory indicated that a very large, untouched stock exists in the central Pacific.

Nakamura has been studying the ability of tunas to see clearly the fine details of objects, especially as they become smaller and move closer together. Few such measurements of any fishes existed, and none of the much-sought fishes of the high seas.

Worked In Sunless Tank House

He worked in a black-painted, sea-water tank house in a sunless building. At the end of the long, narrow tank there was an opal glass plate on which an image could be projected. The image had a pattern of black-and-white stripes of equal width.

A fish soon learned that if the stripes were vertical it would receive a morsel of food at a certain place in the tank. However, if the stripes were horizontal, and it tried to swim to the food-drop area, it would receive no food--and, to impress the lesson upon it, a mild electric shock.

When the fish was trained and testing began, horizontal and vertical stripes were presented at random. The luminance of the stripes was decreased in steps until the fish began to make errors in half the tests. On following days, the fish would be presented with patterns in which the stripes were narrower or broader. In this way, the visual acuity of the skipjack and a related species, kawakawa, or little tunny, was determined.

Nakamura found that when the white stripes were dim, the fish saw about equally well, but when they were brighter, the skipjack's visual acuity was greater.

There is evidence that sight is important to tunas in detecting prey and avoiding predators. Nakamura says it also is used to recognize transient and permanent body marks. Several fishes exhibit transient color markings at certain times, such as feeding or courtship. These markings may convey information about the presence of food to other fish in the school, or signal aggressive intentions. Certain permanent body marks may aid a fish distinguish its own kind from others closely resembling it.

Can See Pinpoint On Clear Day

Nakamura was able to calculate from his measurements how far the skipjack could see prey or body marks under certain conditions. On a clear day, a skipjack tuna about 100 feet down could see an object a few hundreths of an inch long 2 feet away. It could see the transient vertical bars on the flanks of another skipjack about 35 feet away. Permanent body marks on another skipjack would be resolvable at distance of about 10 feet. Nakamura points out, however, that contrast between the object and its background may be as important, or even more, than visual acuity; he was unable to measure contrast. He reports that British workers recently found that the scales of some fishes are ingeniously oriented to reduce contrast between their bodies and the background.

What Nakamura's studies may mean to the fishermen lies in the possibilities they offer of devising improved new gear and techniques for catching fish. Such gear and techniques would be based on scientific studies of the fishes' perceptual abilities and knowledge of their behavior.

La Jolla First to Raise Mackerel and Sardines to Advanced Juvenile Stage

Pacific mackerel and sardines have been raised from egg to "advanced juvenile stage" for the first time anywhere by researchers of the California Current Resources Laboratory at La Jolla.

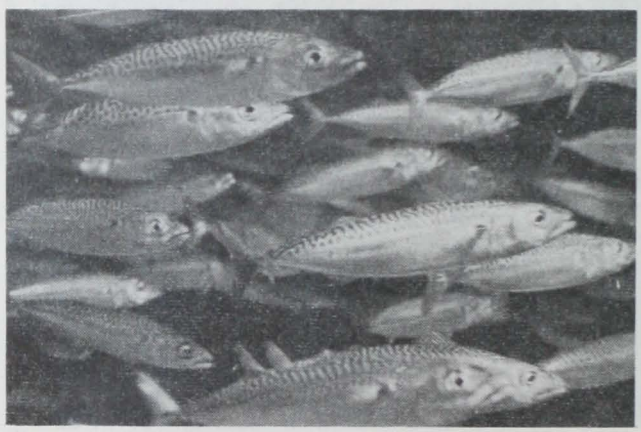


Fig. 1 - Pacific mackerel, 6-8 inches long, reared from the egg, photographed during the week of October 10. Fish were hatched May 20, 1966. (Photo: George Mattson)

Several hundred Pacific mackerel hatched in May 1966 reached 10 inches by year end, attained about half the adult size. Sardines hatched in August 1966 were four inches long, about one-third adult size. Using an experimental aquarium supplied with sea water, Dr. George O. Schumann has reared at least 15 species of marine fish from egg to late juvenile stages.

Dr. Schumann notes: "A key to the success of these experiments is to feed the

proper food at the proper time." He reported that very young fish were fed small amounts of natural plankton (microscopic ocean plants and animals). As the fish grew, they were fed larger amounts of plankton, and also brine shrimp. With a lot of food and warm water some species more than doubled in length during their first two weeks of life.

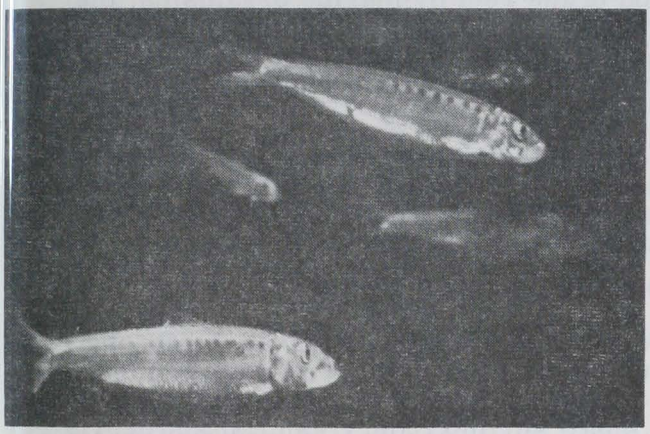


Fig. 2 - Sardines, $2\frac{1}{2}$ to 4 inches long (standard length) photographed during the week of October 10. School has about 50 specimens with a rather wide difference in size. The sardines shown were hatched August 11, 1966. (Photo: George Mattson)

Studies Needed For Conservation of Species

Dr. E. H. Ahlstrom, Laboratory director, said Pacific mackerel and sardines are being studied to gather information needed to conserve and manage the species. "Our successful experiments will enable scientists to study the life history and habits of these fish under controlled conditions. This is one of the most important recent developments in marine fishery biology. Information on marine fish larvae and factors influencing survival will enable scientists to better understand changes in abundance of commercial fish populations. "Rearing and studying the larvae in the laboratory will ultimately provide information leading to international cooperation in regulating the high seas fishery."

Pacific mackerel are an important West Coast fishery. But sardines, the mainstay of a prosperous fishery in the mid-1940s, have become scarce.

La Jolla's Tuna Vessel Research Pays Off

The results of a study by BCF's Tuna Resources Laboratory at La Jolla and a Van Camp Seafood Co. representative have stimulated a tuna vessel fleet owner to convert its vessels for maximum efficiency at relatively modest cost. The study determined the optimum size of tuna vessels that would give maximum return for the effort and money expended. Based on the study, National Marine Terminals of San Diego has started to convert its 12 vessels from about 340 tons carrying capacity to 420 tons--a figure close to the most efficient size of tuna seines disclosed by the study.

The cost of converting each vessel is $75,000. When the project is completed, the fleet's carrying capacity will be 960 tons greater--equivalent to adding 2 new vessels costing $2 million. The company believes the $900,000 program is worthwhile.

BCF's support of its La Jolla Operation Research Program during the study period was much less than $50,000.

King Crab Waste, A Pollutant, Becomes Salable Fish Meal

BCF's Ketchikan (Alaska) Technological Laboratory has used king crab waste to make fish meal, a development that may help to reduce pollution in Kodiak harbor and provide additional income to the king crab industry.

The pollution situation became a real concern to Kodiak when the post-earthquake buildup brought an increasing number of processors and vessels to the area. It was estimated that about 300,000 pounds of butchered waste were dumped into the harbor daily during the peak of the 1965 processing season. The City of Kodiak was forced to enact a stringent pollution-control ordinance.

The reduction process for making meal from crab waste is much easier than it is for other fish byproducts because expensive cookers, presses, and oil recovery equipment are not necessary.

The Ketchikan technologists began to study the possible use of crab meal as animal feed. Using butchering waste only (shell, viscera, and blood), they produced a small quantity of meal containing about 45 percent protein--a surprisingly large amount. If this protein has the same nutritional value (digestibility) as fish meal, it now would be worth $105-$120 a ton.

The technologists went on to a more elaborate experiment. They obtained 5,000 pounds of crab butchering waste and processed it. About 600 pounds will be fed to mink at Petersburg in a cooperative study with the Experimental Fur Farm. The remainder will be used in feeding trials with rats and chickens at the BCF lab in College Park, Md., to compare crab meal protein with fish meal. If the results are favorable, the production of crab meal could lessen the pollution problem at processing centers and add income to the industry.

Holds Sanitation Workshops to Aid Industry

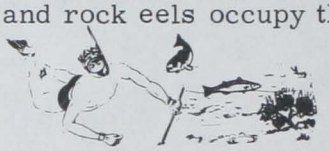
To help several elements of the food processing industry cope with the increased sanitation surveillance of the Food and Drug Administration (FDA), FDA's Bureau of Education and Voluntary Compliance and BCF's Technology and Inspection staff are initiating sanitation workshops for the breaded shrimp and smoked fish processing industries.

The workshops, scheduled to start in early spring, will be held in the Gulf States and in New York City.

Boothbay Lab Studies Lobster Habitat Improvement

An artificial reef built with rock blasted and dredged from the site of a new Coast Guard station is being studied intensively by the BCF Boothbay Harbor (Maine) laboratory's SCUBA diving team. The information gained may help determine the best ways to construct new areas suitable as lobster habitat--and also ways of upgrading marginal areas.

A photographic survey is being made of the reef, which covers about 10,000 square feet of ocean bottom near the mouth of Boothbay Harbor, Maine, in 50 to 80 feet of water. This reef is only 2 months old, but the apparent density of lobsters is already half that of an adjacent natural habitat. Bimonthly photographs of reef parts will document the colonization of the reef by marine organisms; the lobster population will be monitored each month. Besides lobsters, shorthorn sculpins, cunners, and rock eels occupy the reef.



Gloucester's Prototype Shrimp Separator Shows Merit

A shrimp separator designed, built, and tested by the Gloucester Exploratory Fishing Base staff has proved successful in separating small shrimp from trash fish and debris taken together in shrimp trawling operations. Because the shrimp are small and bring a low price, the mechanized separator may make this new fishery more attractive to potential fishermen.

Atlantic Tuna Tagging Shows Definite Trans-Ocean Migration

Of 7,000 tagged tuna released in the Atlantic during 1966, over 600 returns were made during the first 10 months, some from fish tagged in earlier years. It was the second year of BCF support of the program at the Woods Hole Oceanographic Institution.

Several returns were unusually significant: they indicated the complex relation between stocks of Atlantic bluefin tuna. Twelve recoveries showed trans-Atlantic migration of young bluefin released in coastal waters between New Jersey and Cape Cod in summer 1965 and recaptured in Bay of Biscay in summer-early fall 1966. Young bluefin tagged by the Canadians showed a similar migration.

The high number of returns indicates a definite trans-ocean migration rather than accidental wandering.

East-West Migration Unknown

Although young bluefin have been tagged in the northwest Atlantic every year for 13 years, the only similar migration of young fish ever recorded was for two 20-pounders released in 1959 and recaptured in Bay of Biscay in 1959. Until tagging can be done in the Biscay, it will not be possible to know if east-west migration occurs. In the past, giant bluefin marked in Florida straits have been recaptured in Norwegian waters, one even north of Arctic Circle.

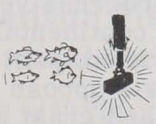
It appears that widely separated bluefin tuna stocks intermingle in unpredictable manner. International programs would be necessary to determine their complex distribution.

BCF Ann Arbor Base Explores Idea of Using LASER for Fish Detection

The possibility of using light amplification by stimulated emission of radiation (LASER) to penetrate the sea's air-water interface to locate and delimit fish schools is being explored by the staff of BCF's Ann Arbor Exploratory Fishing and Gear Research Base. Recently, the matter was discussed with engineers of a private laboratory, who proposed a feasibility study.

This is the approach of the Ann Arbor staff: if the interface can be penetrated--and reflected signals from fish schools returned--then it may become possible to conduct searches for fish schools from fast-moving vehicles such as planes or helicopters. A logical place to start testing would be over a known population of highly abundant schooling fish--using the reliable recordings of echo sounders aboard research vessels to establish the quantity of fish and to help interpret the LASER readings.

BCF's Seattle Base also is interested in the subject.



Menhaden Eggs Found Off North Carolina

A concentration of live menhaden eggs and a spawning area were found for the first time off the Middle and South Atlantic coasts by BCF scientists from the Beaufort, N. C., laboratory aboard the research vessel "Dolphin" on December 17, 1966.

The fairly dense patch of eggs, roughly 5 miles in diameter, was located about 40 miles southwest of Beaufort, N. C. Three stages of embryonic development were represented: blastoderm (about 14 hours), early neurula (24 hours) and late embryo (46 hours). Over 100,000 live eggs and newly hatched larvae were brought into the laboratory for further study of embryonic development.

The area was revisited 36 hours after the discovery and only dead eggs or yolk-sac larvae were caught. This indicates to the scientists that no further spawning had taken place, and that survivors had been carried from search area by winds and currents.

BCF Offers Reward for Tagged Fluke

Cooperating in a study by the Atlantic States Marine Fisheries Commission, BCF is offering rewards for catching tagged fluke: $1.00 for return of tag only; $2.00 for tag intact on the fish.

The fluke are young of the year--tagged in October 1966--when only 3 to 4 inches long. They were tagged in Bay River, Pamlico Sound, N. C., to determine how far they migrate--and whether they contribute to stocks of fluke taken farther north and east of the tagging area.

The tagged fluke are extremely small and commercial fishermen are urged to watch carefully the parts they usually discard. The help of fishermen or anyone handling fish is needed to make this study successful.

Recaptured flounder provide necessary information on migrations and growth rates of this valuable sport and commercial fish.

How To Get Reward

The tag is green, plastic, oblong, small ($\frac{1}{8}$ inch wide x $\frac{1}{2}$ inch long), and is attached to the fish by wire. It shows the message--"SEND TAG: USFWS WOODS HOLE, MASS."

To receive reward for tag only, send it to U. S. Bureau of Commercial Fisheries Biological Laboratory, Woods Hole, Mass., with this information: (1) your name and address; (2) where fish was caught; (3) when caught; and (4) type of gear used. To receive reward for tag intact on the fish, give it to a Federal or State Marine biologist or fisheries agent for observation and measurement, together with your name, address, and other pertinent information.

Prompt acknowledgement will be mailed in both cases with a cash reward and information on the fish tagging.

NOTE: The December 1966 issue of this magazine, page 24, "Boston Trawlers Improve Fish Handling Methods," described an improved fish washing system recently adopted by some Boston trawlers. BCF did not devise the system. The washer is the product of the Great Grimsby Coal, Salt, and Tanning Company, Limited, Grimsby, England; the hatch was designed by Usen Trawling Company, Boston, Mass.

SEA FOSSILS INDICATE MOVEMENTS OF SEA FLOOR

Africa and the Americas may have separated about 160 million years ago, drifting apart at the rate of six-tenths of an inch a year. As reported by scientists of the Lamont Geological Observatory, Columbia University, N. Y., inspection of fossilized sea creatures has shown that for the past 20 to 25 million years the continents have stayed where they are.

Well-preserved samples of fossilized marine animals five-thousandths of an inch in diameter were dredged from two sites on the crest of the undersea ridge that runs down the middle of the Atlantic Ocean. The fossils called foraminifers and coccoliths were dated from the early Miocene epoch about 25 million years ago.

Some scientists have calculated that the crest of the undersea ridge is much younger than the flanks and that the ocean floor crusts become progressively older toward the continents. These scientists adhere to the theory of continental drift--the idea that the continents were once joined together and then drifted apart through the ages to create the Atlantic and Indian Oceans. Other scientists oppose the drift theory saying that the locations of the continents, ocean basins and crust are permanent. (Reprinted, with permission from Science News, weekly summary of current science, c 1966 by Science Service, Inc.)