TRENDS AND DEVELOPMENTS

Alaska Fisheries Explorations and Gear Development

SHRIMP RESOURCES IN SOUTHEASTERN WATERS SURVEYED:

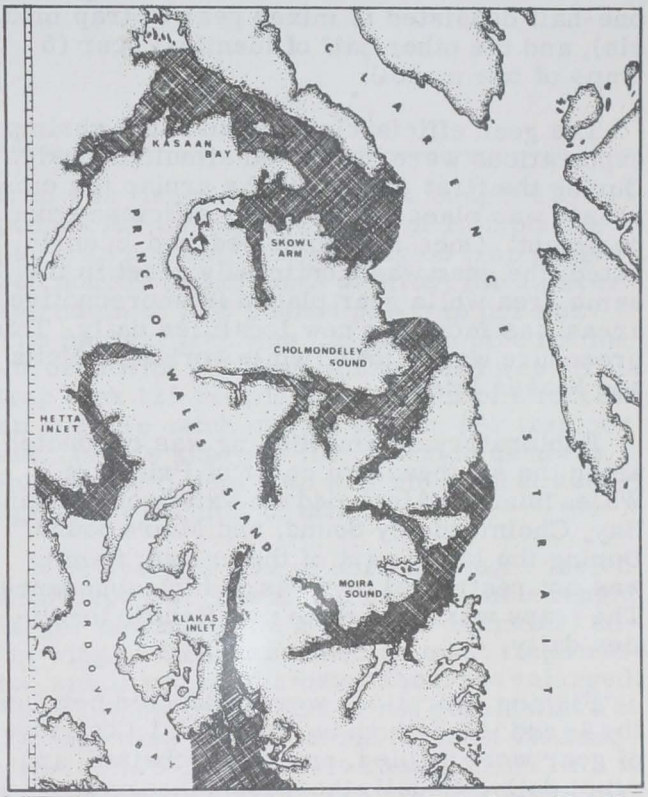
M/V "Little Lady" Cruise 66-1 (April 18-June 13, 1966): The exploratory fishing vessel, Little Lady, chartered by the Bureau of Commercial Fisheries, U. S. Department of the Interior, completed a 57-day exploratory shrimp cruise in June 1966 for spot (Pandalus platyceros) and coon-stripe shrimp (Pandalus hypsinotus). The vessel operated in the Cordova Bay vicinity and along the southeastern coast of Prince of Wales Island in southeast Alaska.

Principal objectives of the cruise were to: (1) locate commercial concentrations of spot and coon-stripe shrimp; (2) collect data on the distribution and abundance of those species; and (3) observe the relative fishing efficiency of 6 types of shrimp pots.

The gear experiment was designed to test the relative fishing efficiency of 6 different models of shrimp traps plus 2 variations in construction features. The six models of shrimp traps include:

(1) Rectangular wood lath trap, 18x18x30", iron bark frame covered with $1\frac{1}{2}$" wide spruce lath. Two conical tunnels of $1\frac{1}{2}$" stretch-mesh nylon web with 9"-$10\frac{1}{2}$" lead-in. Two-inch (inside diameter) white plastic rings were fastened at the tunnel apex (trap type #8).

(2) Rectangular metal frame trap, 18x18x30", reinforcing steel rod ($\frac{3}{8}$") frame covered by burlap and $1\frac{1}{2}$" stretch-mesh nylon web. Two conical tunnels constructed of $\frac{3}{4}$" stretched-mesh nylon web. Tunnel lead-in 13" (long, trap type #14) and 9" (short, trap type #9) with 2" (inside diameter) white nylon rings at the apex.



Shows area of operations during M/V Little Lady Cruise 66-1 (April 18-13, 1966).

(3) Plastic igloo trap, 24" in diameter and $10\frac{1}{2}$" high (trap type #10).

(4) Rectangular plywood trap, 18x18x36", iron bark frame sheeted with $\frac{3}{8}$" plywood. Two sloping ramp tunnels were constructed of plywood frames covered with $\frac{3}{8}$" mesh nylon web. The tunnel openings were $1\frac{1}{4}$" deep by 18" wide (trap type #11).

(5) Rectangular plastic pipe frame trap, 18x18x36", $\frac{1}{2}$" plastic PVC-type pipe covered with burlap (trap type #5), or $\frac{3}{8}$" nylon web (trap type #15), two conical tunnels constructed of $\frac{3}{8}$" nylon mesh, lead-in $15\frac{1}{2}$", with 2" (inside diameter) white rings at the apex.

(6) Circular collapsible trap, frame constructed of $\frac{3}{8}$" and $\frac{2}{8}$" galvanized steel wire covered by $1\frac{1}{4}$" stretched mesh nylon web, four $2\frac{1}{4}$ x $2\frac{7}{8}$" oval tunnels spaced every 90° with short leads (trap type #13).

A total of 72 shrimp traps (12 of each model) was fished using the long-line method. A long line consisted of 6 traps attached to the groundrope by one-fathom dropper lines spaced at five-fathom intervals. Of the 12 long lines, one-half consisted of mixed gear (6 trap models), and the other half of identical gear (6 traps of one model).

The gear efficiency study and spot shrimp explorations were conducted simultaneously. During the first portion of the cruise the emphasis was placed on the gear efficiency experiment. Once a shrimp bed had been located, the gear was continually reset in the same area while gear placed in unproductive areas was moved to new localities daily. This procedure was followed while working in Hetta and Klakas Inlets.

Exploratory shrimp fishing was conducted along the southeastern coast of Prince of Wales Island and included the waters of Kasaan Bay, Cholmondeley Sound, and Moira Sound. During the latter part of the cruise, fishing was not restricted to areas of high abundance. The traps were moved to new fishing localities daily.

Fishing operations were conducted between the 8- and 103-fathom isobaths. All 12 strings of gear were hauled, emptied, rebaited, and reset daily. Usually the traps fished or soaked for 18 to 28 hours.

Catches from the 38 stations revealed large concentrations of spot shrimp in Hetta and Klakas Inlets and Cholmondeley and Moira Sounds. The catches ranged from 0 to 313 pounds per set (72 traps), and averaged 132 pounds per set. The total catch for the 38 stations was 5,018 pounds or 1.88 pounds per trap per set. Small catches of coon-stripe and pink shrimp (less than 2 pounds) occurred occasionally.

Eight stations were fished in Hetta Bay at depths from 12 to 103 fathoms. Good abundance of spot shrimp was found in the depth interval of 50 to 90 fathoms with the center of abundance occurring at 60 to 70 fathoms. The catch per station ranged from 45 to 263 pounds and averaged 164 pounds (or 2.3 pounds per trap per set).

Eleven stations were made in Klakas Inlet and just outside its entrance. Catches of spot shrimp ranged from 1 to 313 pounds per station and averaged 176 pounds (or 2.44 pounds per trap per set). Operations were conducted at depths from 15 to 92 fathoms and good abundance was found from 15 to 65 fathoms while the center of abundance was from 40 to 55 fathoms.

Six stations were fished in Kasaan Bay and Skowl Arm. Results indicated a low abundance of spot shrimp in those waters. Catches ranged from 0 to 102 pounds per station and averaged 35 pounds (or 0.49 pounds per trap per set). Explorations were conducted from 28 to 85 fathoms, with good abundance occurring between 46 and 62 fathoms.

Six stations in Cholmondeley Sound showed a high abundance of spot shrimp. Catches ranged from 38 to 263 pounds per station and averaged 126 pounds (or 1.75 pounds per trap per set). Station depths ranged between 32 and 90 fathoms. Good concentrations were found at depths from 35 to 90 fathoms, with the center of abundance occurring at 50 to 75 fathoms.

One station in Johnson Inlet and just outside its entrance resulted in a very poor showing (3 pounds).

Table 1 - Average Catch Per Station, Catch Per Trap Per Station, Depths Fished, Depths of Good Abundance and Depth of the Center of Abundance

Area	Total Catch	Stations	Range of Catches	Average Catch Per Station	Average Catch Per Trap Per Set	Depth Fished	Good Abundance 1/	Center of Abundance
	Pounds	No.	(Pounds)			(Fathoms)		
Hetta Inlet	1,310	8	45-263	164	2.3	12 - 103	50 - 90	60 - 70
Klakas Inlet	1,935	11	1-313	176	2.44	15 - 92	15 - 65	40 - 55
Kasaan Bay	210	6	0-102	35	0.49	28 - 85	35 - 90	-
Cholmondeley Sound	758	6	38-263	126	1.75	32 - 90	32 - 90	50 - 75
Johnson Inlet	3	1	3	3	-	20 - 87	-	-
Moira Sound	802	6	38-238	134	1.86	25 - 85	40 - 73	50 - 65
Total	5,018	38	0-313	132	1.88	12 - 103	15 - 90	40 - 75

1/One (1) string producing 10 or more pounds of spot shrimp.

Table 2 - Average Catch of Spot Shrimp Per Trap Per Set and the Average Number of Whole Shrimp Per Pound by Trap Model

Trap Type 1/	Total Pounds	Units of Effort	Average Catch/Trap/Set In Pounds	No. of Shrimp	Average No. of Whole Shrimp/Pound
9	355	135	2.63	5,624	15.9
14	210	94	2.23	3,130	14.9
8	477	220	2.17	7,239	15.2
11	470	220	2.14	5,700	12.1
13	468	235	1.99	6,134	13.1
12	178	110	1.62	3,147	17.7
10	349	225	1.55	4,454	12.8
15	125	119	1.05	2,040	16.4

1/ 9. Metal frame, burlap covered, short tunnel.
14. Metal frame, burlap covered, long tunnel.
8. Wood lath trap, short tunnel.
11. Plywood trap, sloping tunnel.
13. Circular collapsible trap.
12. Plastic pipe frame trap, burlap covered.
10. Plastic Igloo trap.
15. Plastic pipe frame trap, $\frac{3}{8}$" nylon web covered.

Six stations in Moira Sound showed a good abundance of spot shrimp. Catches ranged from 38 to 238 pounds and averaged 134 pounds per station (or 1.86 per trap per set). The traps were set at depths from 25 to 85 fathoms. Good abundance of spot shrimp were found from 40 to 73 fathoms, with the center of abundance occurring between 50 and 65 fathoms.

Results of the shrimp explorations indicated commercial concentrations of spot shrimp are available in Hetta and Klakas Inlets, and Cholmondeley and Moira Sound. Two commercial vessels were fishing those areas at the time.

Data used in the analysis of the gear efficiency study were restricted to observations made on the six strings of mixed gear. Analysis of the data collected at the 38 stations showed that the metal frame trap equipped with short and long tunnels were rated first and second, respectively. The short tunnel, metal frame, fished 135 times caught 354 pounds for an average catch of 2.63 pounds per trap per set, while the long tunnel trap was fished 94 times and caught 210 pounds or an average catch of 2.23 pounds per trap per set. The third most efficient trap was the wood lath, which caught 477 pounds of shrimp in 220 units of effort for an average catch of 2.17 pounds per trap per set. This trap was followed closely by the plywood trap which took 470 pounds of spot shrimp in 220 units of effort for an average catch of 2.14 pounds per trap per set. The circular collapsible trap was the 5th most efficient and caught 468 pounds in 235 units of effort for an average catch of 1.99 pounds per trap per set. The 6th and 7th most efficient traps were the plastic pipe frame, burlap covered, and the plastic igloo trap, respectively. The plastic pipe trap was fished 110 times and caught 178 pounds for an average catch of 1.62 pounds per trap per set, while the igloo trap caught 349 pounds in 225 units of effort for an average catch of 1.55 pounds per trap per set. The poorest trap was the plastic pipe frame covered with $\frac{3}{8}$" woven mesh nylon web. This trap took 125 pounds in 119 units of effort for an average catch of 1.05 pounds per trap per set. In this analysis the criterion used for the most efficient trap was the highest average catch per unit of effort.

The average size of shrimp caught varied with trap type. The larger entry tunnels caught larger shrimp. The 2" (inside diameter) entry rings which were used on most traps were too small and the diameter should be enlarged. The optimum tunnel size is not yet known. The average size of the shrimp taken in the trap with the two-inch tunnels ranged from 14.9 to 17.7 whole shrimp per pound. The igloo, plywood, and circular collapsible traps which had larger openings caught shrimp which averaged from 12.1 to 13.1 whole shrimp per pound.

Note: See Commercial Fisheries Review, July 1966 p. 14, December 1965 p. 25.

California

VARIOUS SPECIES OF FISH COLLECTED FOR BIOLOGICAL STUDIES:

M/V "N. B. Scofield" Cruise 66-S-1 (February 10-24, 1966): The purpose of this cruise by the California Department of Fish and Game research vessel N. B. Scofield was to: (1) collect eye lenses and blood smears from different fish species caught at widely sep-

arated locations, and (2) obtain pathological specimens, especially tumors, from marine species. The area of operation was in the waters of the southern California Channel Islands and offshore along the coast of Baja California.

Eye lenses, taken from 36 species caught at 15 locations, were analyzed electrophoretically to determine the characteristics of their protein composition. The information was to be used in identifying genetically-distinct populations and in studying phylogenetic relationships.

A series of 4 blood smears was taken from 20 species of fish. They were to be used in hematological studies of different taxonomic groups. During the cruise, a suspect melanistic sarcoma was collected from a bocaccio (Sebastodes paucispinus).

Note: See Commercial Fisheries Review, January 1966 p. 17.

* * * * *

SURVEY OF SHRIMP RESOURCES IN COASTAL WATERS CONTINUED:

M/V "N. B. Scofield" Cruise 66-S-2 (March 18-April 27, 1966): The objectives of this cruise by the research vessel N. B. Scofield in the coastal waters from the Oregon border to Eureka, Calif., were to: (1) randomly sample concentrations of pink shrimp (Pandalus jordani) for determining population estimates and natural mortality rates; (2) determine size, sex, and weight of shrimp; (3) examine Pacific hake (Merluccius productus) stomachs for relative abundance studies of pink shrimp; (4) sample surface and intermediate waters for juvenile shrimp; (5) sample the bottom fauna of the shrimp bed; and (6) save all rare or unusual invertebrates and fishes for the State Fisheries Laboratory, Terminal Island, and various collections.

The 153 tows made during the cruise were distributed at random over the 270 square-mile survey area between the mouth of Mad River and the Oregon border. Fishing depths ranged from 38 to 110 fathoms. A semi-balloon Gulf of Mexico shrimp trawl with a 41-foot head rope and a one-inch stretch mesh net was used. A $\frac{1}{2}$-inch stretch-mesh liner was used in the cod end of the net to prevent escapement of small one-year-old shrimp.

One unchartered snag was encountered west of Redding Rock in 36 fathoms. This resulted in the loss of a net and otter boards.

Approximately 102 square miles of the survey area contained sufficient concentrations to provide about 50 pounds of shrimp an hour using commercial size nets. About 36 square miles of that area yielded catches equivalent to 300 pounds or more an hour if commercial size nets were used.

Excluding catches under 34 pounds an hour, the average catch was 355 pounds and ranged from 35 to 3,549 pounds. The 270-square mile survey area contained an estimated 5.1 million pounds of shrimp. Counts per pound ranged from 70 to 299 with a mean of 147. About 72 percent of the shrimp population was located 12 miles or less from shore.

A total of 263 Pacific hake stomachs were examined for pink shrimp; the stomachs contained 135 identifiable shrimp.

Unusual fish species collected during the survey included: 2 bearded eelpouts (Lycenema barbatum); 1 rough ronquil (Rathbunella alleni); 1 smooth tongue (Leuroglossus stilbius); 1 short-fin eelpout (Lycodes brevipes), 1 red brotula (Brosmophycis marginata); 1 blue spotted poacher (Xeneretmus triacanthus); and 1 tadpole snailfish (Nectoliparis pelagicus).

Note: See Commercial Fisheries Review, March 1966 p. 21.

* * * * *

OCEANOGRAPHIC STUDIES IN CALIFORNIA COASTAL WATERS:

M/V "N. B. Scofield" Cruise 66-S-3 (April 30-May 1, 1966): To determine the salinity and temperature of waters adjacent to proposed marine laboratory sites which may be used in conjunction with the temperature and salinity profiles of Monterey Bay reported by Hopkins Marine Station, was the purpose of this cruise by the research vessel N. B. Scofield. The vessel operated in California coastal waters from Santa Cruz to Davenport Landing.

Sea surface temperatures were continuously recorded by thermograph. Water samples and bathythermograph (BT) casts were made every 2 miles along the 10-, 20-, and 40-fathom contours from Santa Cruz Point to El Jarro Point.

The lowest surface temperature (53° F.) was recorded at one of the stations worked. The highest temperature (58.8° F.) was re-

corded inshore near Santa Cruz Point. Temperatures were fairly uniform at offshore stations, and ranged between 57° and 58° F; the temperature inside Santa Cruz Harbor was 60.8° F.

Salinities ranged from 32.9 to 34.2, and were generally higher near shore as a result of upwelling occurring at two stations covered.

Bathythermograph casts made at 8 stations showed a strong thermal gradient between the surface and 150 feet. A clear thermocline was evident, beginning at 30 feet below the surface at a number of stations.

The salinity and temperature pattern was typical for the Monterey Bay area. The influence of upwelling is apparently less pronounced in the Santa Cruz Point area, and this may account for the higher temperatures around the Point and in the harbor area.

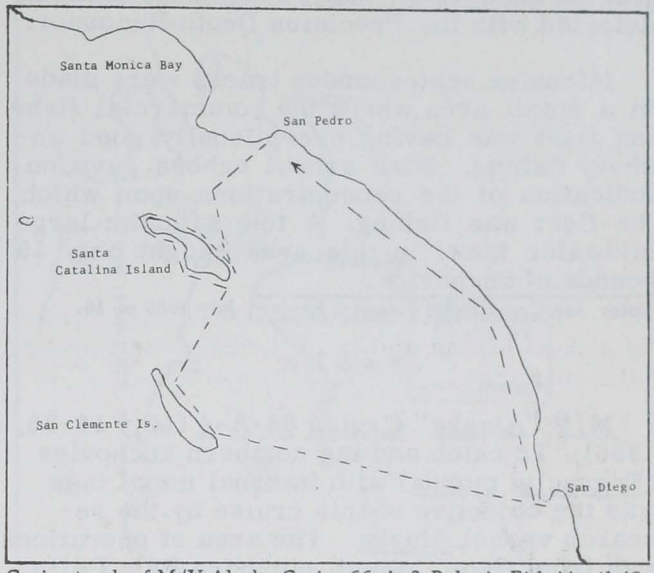
* * * * *

PELAGIC FISH POPULATION SURVEY CONTINUED:

M/V "Alaska" Cruise 66-A-3-Pelagic Fish (April 19-May 4, 1966): The coastal waters of southern California from Santa Catalina Island to San Diego were explored during this cruise by the research vessel Alaska, operated by the California Department of Fish and Game.

Objectives of the cruise were to: (1) evaluate midwater trawl openings using various otter door and bridle arrangements; (2) compare fishing efficiencies of a 50-foot and 28-foot midwater trawl; (3) study the effect of towing speed on midwater trawl catches; (4) experiment and gain experience fishing a lampara net for catching anchovies for tagging; and (5) develop procedures and techniques for tagging anchovies aboard the Alaska.

Mouth openings of a 50-foot square midwater trawl and a 28-foot trawl were observed with a look box. Best results were obtained using 4 hydrofoil otter doors. The large net opened between 45 and 50 feet horizontally and about 35 feet vertically. A poor vertical opening resulted when the two lower hydrofoil doors were replaced with weights. The small net opened both vertically and horizontally to an estimated 28 feet which is very close to the designed optimum.



Cruise track of M/V Alaska Cruise 66-A-3-Pelagic Fish (April 19-May 4, 1966).

A maximum towing speed of 4.0 knots was attained with each trawl. No problems were encountered although both fished at considerably shallower depths than when towed at slower speeds.

Fishing efficiencies of each size trawl were compared by towing each on alternate nights at the same location. Results indicate the large trawl catches about twice as many anchovies as the small one.

One comparison was made of anchovy catches with the small net towed at two different speeds. The regular speed of 2.80 knots was compared with 4.25 knots. The higher speed resulted in a catch 3.5 times greater than the regular, but the fish were severely damaged.

A small lampara net was set numerous times from a large skiff to gain experience for future anchovy tagging operations. Fouling of the cork and lead line necessitated modification of the net.

A total of 2,952 anchovies were tagged and released. Several major problems arose during this operation, most of which were solved at sea. Valuable experience and ideas were gained for improving future tagging operations.

Anchovies were very abundant throughout the entire area encompassed by the cruise. During flat, calm weather hundreds of breezing schools were observed in deep water between the coast and offshore islands. A dozen nightlight stations were occupied, and all at-

tracted anchovies. Many schools were also detected with the Precision Depth Recorder.

Intensive echo-sounder tracks were made in a small area where the commercial fishing fleet was having exceptionally good anchovy fishing. Fish school echoes gave no indication of the concentrations upon which the fleet was fishing. A tow with the large midwater trawl in this area caught only 15 pounds of anchovies.

Note: See Commercial Fisheries Review, July 1966 p. 16.

* * * * *

M/V "Alaska" Cruise 66-A-4 (May 16-26, 1966): To catch and tag northern anchovies (Engraulis morda) with internal metal tags was the objective of this cruise by the research vessel Alaska. The area of operations was from Cape Colnett, northern Baja California to San Diego in southern California.

The area from Ensenada to Cape Colnett was scouted and light stations were made in various localities to attract fish. Anchovies were caught by blanket net near Todos Santos Island, tagged and released at Point San Isidro. Fish schools were found in other localities, but anchovies were not caught in sufficient quantities for tagging.

Anchovies were purchased from the local live-bait operator at Ensenada, tagged on two successive days, and released in areas north of Ensenada. Fish were also purchased from a San Diego bait operator, tagged and released 8-10 miles off Point Loma and La Jolla. Wherever possible, the fish were released on another fish school attracted by light or detected with the fathometer.

Note: See Commercial Fisheries Review, March 1966 p. 19.

* * * * *

ABALONE OBSERVATIONS AND GROWTH STUDIES CONTINUED:

M/V "Mollusk" Cruise 66-M-1 (May 21-June 6, 1966): To determine the red abalone (Haliotis refescens) population by utilizing stratified random sampling techniques was the main objective of this cruise by the California Department of Fish and Game research vessel Mollusk. Other objectives were to tag red abalone at each sampling site for growth and fishing mortality estimates, and to investigate ecological relationships of red abalone. The vessel operated in the coastal area from Point Estero to Cambria.

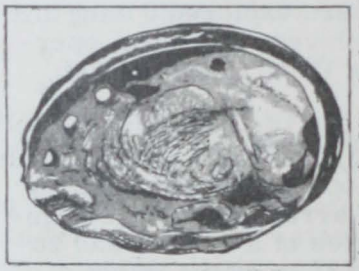
A total of 30 diving stations were selected at random, each measured 15 feet wide by 100 feet long. Station depths ranged from 22-70 feet. All recoverable abalone were collected and measured; those measuring more than 4 inches were tagged and replaced at each station.

Temperature measurements, visibility estimates, substrate characteristics and obvious living quantities were recorded at each station.

Fair to good weather was generally present during the cruise. Surface temperatures ranged from 10.5° C. (50.9° F.) to 12.0° C. (53.6° F.); bottom temperatures varied from 9.9° C. (49.8° F.) at a depth of 40 feet to 11.5° C. (52.7° F.) at a depth of 32 feet. Moderate to strong westerly winds pushed a mass of cooler water through the survey area during the latter part of the cruise.

Estimates of bottom visibility averaged about 11 feet, ranging from 6-25 feet There was less visibility in surface waters due to heavy plankton concentrations.

A total of 355 red abalone was counted at 24 of the 30 stations. They ranged from 5.1 centimeters (2 inches) to 23.1 centimeters (a little more than 9 inches) in greatest length. There were 25 less than 4 inches; 282 ranged from 4 inches to $7\frac{3}{4}$ inches; and 48 were commercial legals ($7\frac{3}{4}$ inches and greater).



Red Abalone Shell
(Haliotis rufescens)

Of the 6 stations not producing red abalone, 1 was entirely on sand; 2 were primarily on sand but had a few small, scattered rocky outcrops; the remaining 3 were in 65- to 70-foot depths, marginal depth for red abalone in that area. However, flat abalone (H. walallensis) and pinto (H. kamtschatkana), were common to abundant at those latter 3 stations, and were frequently seen throughout the survey. Flat abalone up to 2 inches in greatest length were often collected beneath giant red urchins (Strongylocentratus franciscanus).

All red abalone examined appeared to be in excellent condition. Recent shell growth

was exhibited by all specimens, measuring as much as 24 millimeters (almost 1 inch). With the exception of 3 large old-shell adults, abalone shell growth appeared quite uniform.

Stainless steel tags were fixed through the respiratory pores of 268 red abalone. Tagged abalone were replaced at the diving sites.

Exceptionally dense beds of bull kelp (Nereocystis luetkeana), were developing throughout the survey area. Some of this year's sporophytes already extended to the surface from 40-foot depths, although the majority of plants were from 8 to 20 feet long.

Fish species common to most rocky bottom stations were blue rockfish (Sebastodes mystinus), black rockfish (S. melanops), kelp rockfish (S. atrovirens), cabezon (Scorpaenichthys marmoratus), and kelp greenling (Hexagrammos decagrammus). Dominant sand bottom invertebrates were the snail (Olivella biplicata), and the sand dollar (Dendraster excentricus).

A large school of basking sharks (Cetorhinus maximus) was sighted off Point Estero on June 5, moving in a southerly direction.

Note: See Commercial Fisheries Review, April 1965 p. 21.

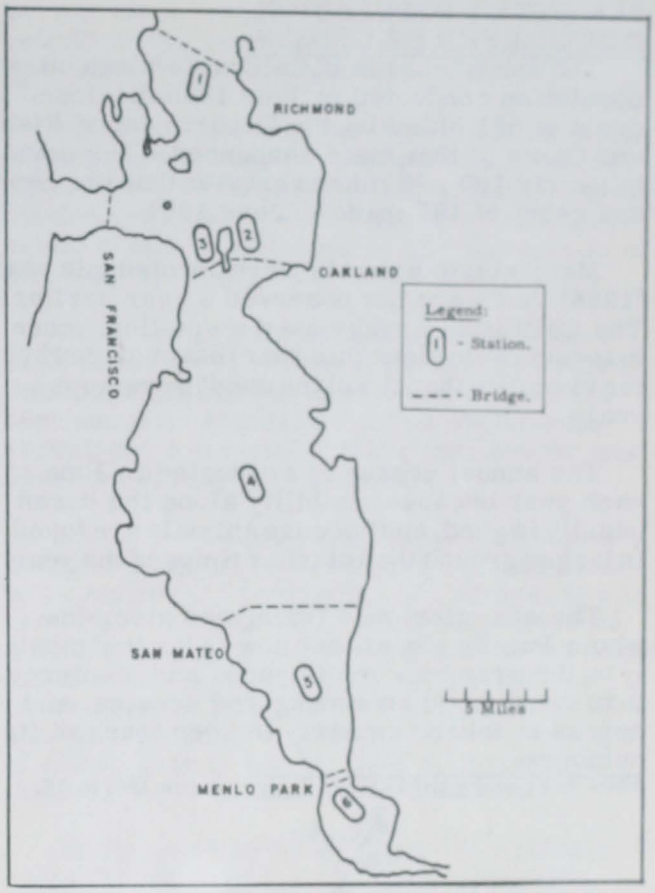
* * * * *

SAN FRANCISCO BAY INVESTIGATIONS CONTINUED:

M/V "Nautilus" Cruise 65-N-2 (July 27-August 1, August 26-30, September 25-30, November 2-7, November 30-December 5, and December 16-21, 1965): Studies in San Francisco Bay were resumed with these cruises by the research vessel Nautilus, operated by the California Department of Fish and Game. Objectives were to collect fish and invertebrates and determine their distribution and seasonal population variations.

The six stations worked in the Bay study area had an average depth ranging from 15 to 50 feet. Station locations were: $\frac{1}{2}$ mile southeast of Redrock; $\frac{1}{4}$ mile east of middle of east side of Treasure Island; $\frac{1}{4}$ mile west of middle of west side of Treasure Island; $\frac{1}{4}$ mile west of radar pylon on San Bruno shoal; $\frac{1}{2}$ mile north of red buoy at entrance of channel to Redwood City Harbor; $\frac{1}{4}$ mile east of Dumbarton railroad bridge.

During the cruise a square-mouthed midwater trawl 25 feet on a side was towed for 20 minutes at the surface. Each station was also sampled by a 20-minute bottom tow with a 15-foot otter trawl having 1-inch mesh.



Area of operations of M/V Nautilus Cruise 65-N-2 (July-December 1965).

As compared to 1963 and 1964, mean temperatures in 1965 were higher in the summer with a maximum of 19.7° C. (67.1° F.) in August. September and October were colder in 1965 than in 1963 and 1964. In November and December there was little difference in temperatures for the 3 years.

Salinities in 1965 generally fell between those of 1963 and 1964. Maximum for 1965 was 30.4 percent in August, and minimum was 27.3 percent in December.

A total of 72 tows yielded 122,958 fish of 53 kinds, but catches from a similar number of drags were not recorded due to gear malfunction, too many fish to hoist aboard, or replication of sampling.

Note: See Commercial Fisheries Review, October 1965 p. 24.

* * * * *

SEA OTTER POPULATION DETERMINED BY CENSUS:

The annual census of California's sea otter population conducted in June 1966 disclosed a count of 591 animals, the Department of Fish and Game of that state announced. The count is nearly 100 individuals greater than the census count of 497 made in June 1965.

Many single animals were counted this year (1966) that were not observed a year earlier. The California agency used a smaller, more maneuverable plane this year that provided better visibility than the plane used in previous years.

The annual census is conducted in June of each year because visibility along the ocean usually is good, and because animals are found in larger groups than at other times of the year.

The sea otter once flourished along the whole Pacific Coast, but now is limited mostly to the area between Cayucos and Monterey. It is considered an endangered species, and a census is taken regularly to keep track of its numbers.

Note: See Commercial Fisheries Review, August 1964 p. 15.

Cans--Shipments for Fishery Products, January-April 1966

A total of 705,491 base boxes of steel and aluminum was consumed to make cans shipped to fish and shellfish canning plants in Jan.-Apr. 1966, as compared with 894,564 base boxes used during the same period in 1965.

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.

Central Pacific Fisheries Investigations

TUNA BEHAVIOR AND HEARING ABILITY STUDIES:

The first measurements of the hearing abilities of a tuna have been made at the Interior Department's Bureau of Commercial Fisheries Biological Laboratory, Honolulu, Hawaii, in experiments carried out over the last 3 years. Traditional methods of fishing are based on two facets of tuna behavior--they eat smaller fish and they form themselves into schools. Fishery scientists believe that closer study of other aspects of sensory capability and behavior may lead to clues that will increase the fishermen's ability to take the fish.

The fish used in the hearing experiments were yellowfin tuna (Thunnus albacares), which account for almost half of the United States tuna catch. They had been taken off the Hawaiian Islands and held in sea-water tanks at the Honolulu Laboratory's Kewalo Basin facility.

The experiments showed that the yellowfin tuna heard most acutely sounds between 300 and 500 cycles per second. These are relatively low-pitched sounds, in the neighborhood of the middle A on the piano. The yellowfin tuna could not hear sounds higher than about 1,100 cycles nor those lower than about 50 cycles per second.

To obtain the data, yellowfin were trained to respond to an underwater sound signal (produced by a transducer) by changing their direction of swimming. The fish were rewarded by a bit of food after each successful try. The intensity of the sound, for each frequency, was reduced until the fish made errors on half the trials. The value at that time was called their threshold of hearing.

The first measurements of the hearing ability of yellowfin tuna agreed with several such studies of other marine fish. The tuna's hearing ability is neither remarkably good nor remarkably bad by piscine standards.

What role hearing plays in the tuna's behavior is not as yet known. One possibility is that it may help them locate prey, for the sound of small fish swimming falls into the frequency range in which the tuna's hearing is most acute. Another possibility is that hearing may be used to receive signals from their own species.

It was observed that the tunas made two sounds--one is called a "snap," which "is similar to the sound made by striking a wooden pencil against a table edge." It occurred when a yellowfin shut its jaw sharply. The

other sound was named the "unh." It is "a grunt-like sound that occurred when the yellowfin flexed its body to avoid an obstacle." It was believed that the "unh" might well be used as a means of communication between yellowfin. In a school about ½ mile across, such a signal need be relayed only 25 times to cover the distance.

The Bureau scientist who conducted the experiments presented his results at a Symposium on Marine Bio-Acoustics at the American Museum of Natural History, New York. His paper was to be published in the Proceedings of the Symposium. These studies are now being extended to other species of tuna.

Note: See Commercial Fisheries Review, July 1965 p. 20.

* * * * *

OCEANOGRAPHIC RESEARCH PROJECT CONDUCTED SOUTH OF THE HAWAIIAN ISLANDS:

M/V "Townsend Cromwell" Cruise 22 (February 10-March 5, 1966): To study the wake system downstream of the Hawaiian Islands, locating the major eddies that make up this system and determining their apparent origin while studying the changes in salinity and temperature distributions in the area of the wake, was the main objective of this cruise by the research vessel Townsend Cromwell. The vessel is operated by the Bureau's Honolulu Biological Laboratory. The area of operations was south of the Hawaiian Island chain, within the area bounded by latitude 17° to 22° N., and longitude 156° to 162° W.

Other objectives of the cruise were to: (1) look for and record any association between fish schools and bird flocks and the wake system, and (2) release drift cards and bottles in the cruise area.

During the first part of the cruise, a large cyclonic (counterclockwise) eddy was found just west of the island of Hawaii, together with 3 smaller anticyclonic eddies to the south and west of Hawaii, and 1 or 2 minor, ill-defined cyclonic eddies to the northwest.

The second part of the cruise was devoted to a detailed study of the largest eddy and its smaller neighbors to the south and west. A total of 26 salinity-temperature-depth (STD) casts was made, to determine salinity and temperature within and between these eddies down to 1,000 meters (3,281 feet) and permit calculation of dynamic topography; details of the thermal structure were studied by means of the bathythermograph (BT).

Watches were kept for bird flocks and fish schools throughout the cruise. As in previous cruises of this series, no clear-cut association could be detected between the occurrence of flocks and schools and the details of the eddy system.

A total of 1,224 drift bottles and 1,250 drift cards were released during the cruise; thermograph and barograph were operated continuously; standard marine weather observations were made; and pyranometer was operated during daylight hours.

The largest eddy, associated with a pronounced dome in the thermocline, was found to be stationary throughout the cruise; it was probably the same eddy which was detected during a January cruise by means of BT casts made in the same area. If so, its lifetime in its original position was at least 2 months and perhaps longer, since it showed no signs of either growth or dissipation during the interval.

On the other hand, the smaller cyclonic eddies to the south, which are associated with depressions in the thermocline, were found to travel westward at speeds of the order of 5 miles per day. Since these eddies occur at regular intervals--about 120 miles apart--if the system is at or near equilibrium, one such eddy must be generated upstream every 3 weeks or so.

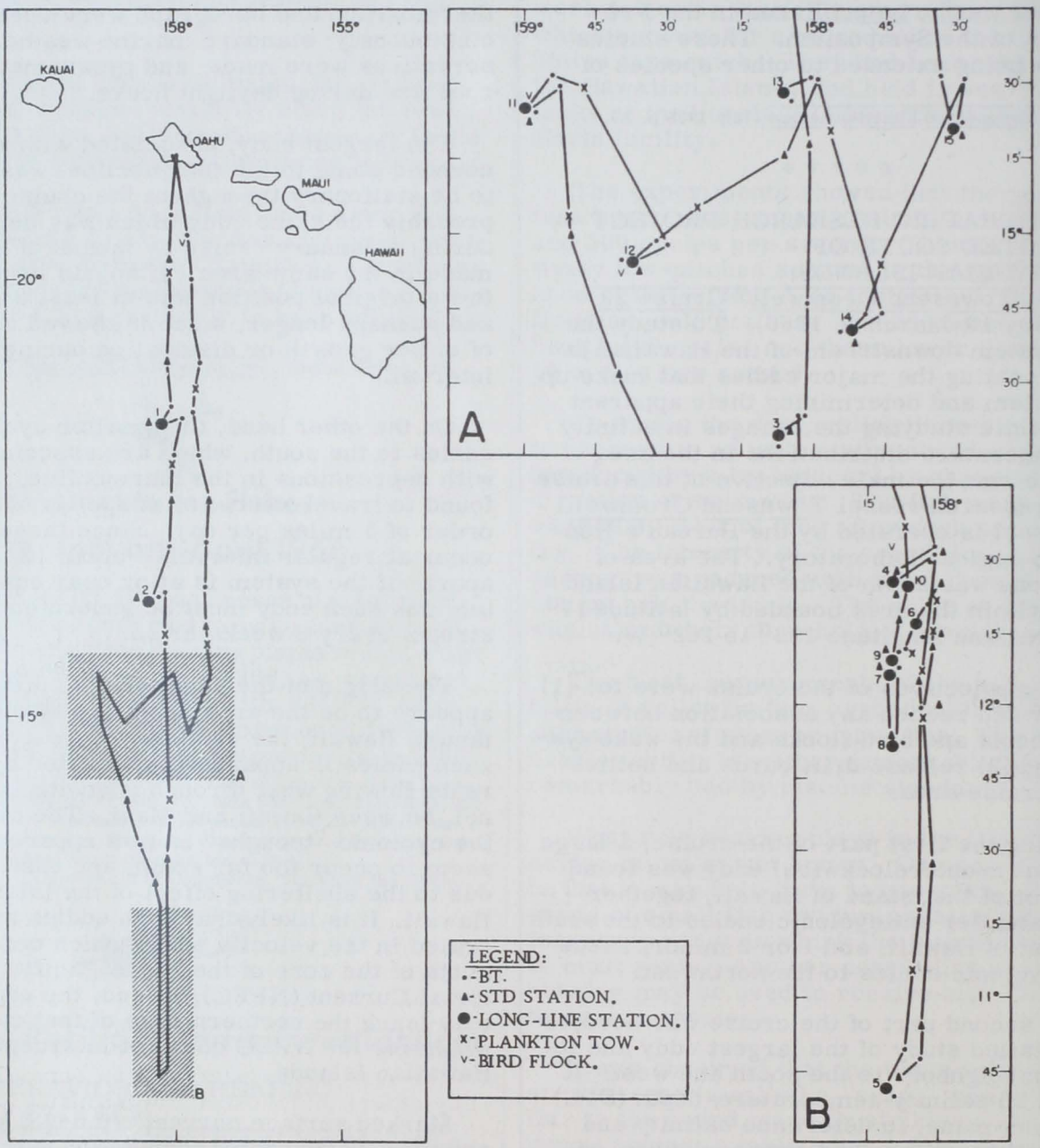
The origin of the anticyclonic "domes" appears to be the area in the lee of the island of Hawaii; the vorticity represented by such eddies is apparently generated by currents flowing west through Alenuihaha Channel, between Hawaii and Maui. The origin of the cyclonic "troughs" is less apparent. They seem to occur too far south, and east, to be due to the sheltering effect of the island of Hawaii. It is likely that such eddies are generated in the velocity shear which occurs north of the core of the North Pacific Equatorial Current (NPEC); indeed, the eddies may mark the northern edge of that current whenever the NPEC does not intercept the Hawaiian Islands.

Marked surface currents (0.5-2.0 knots or more) occurred in conjunction with each of the eddies, as was evident from the drift

of the vessel. The direction of drift coincided closely with the motion which each eddy would induce, and the speed appeared directly proportional to the slope of the thermocline. This suggests that the field of motion could be determined rapidly, and with accuracy adequate for Coast Guard rescue operations, through the use of BT's alone.

M/V "Townsend Cromwell" Cruise 23 (March 14-April 1, 1966): The water structure in the area south of Oahu was studied during this cruise by the Bureau's research vessel Townsend Cromwell. Other objectives were to: (1) study the relative abundance of apex predators in this area by means of long-line fishing and to relate it to significant oceanographic features, and (2) preserve big-eyed tuna blood samples for subpopulation studies.

An increasing number of Hawaiian long-liners are fishing in this area (between 350 to 600 miles south of Oahu), and some of the



Track chart of research vessel Townsend Cromwell Cruise 23 (March 14-April 1, 1966).

best catches of big-eyed tuna in recent years were made there.

A total of 34 STD lowerings and 55 BT lowerings were made to study the water structure in the vicinity of the cooperating Hawaiian long-liners (the Kaku, Pulpo, and Aukai) and southward to the subsurface front area. The STD lowerings made while traveling south indicated that the subsurface front was located approximately at latitude 12°30' N., longitude 158°00' W. The results showed that the long-liners were fishing about 180 miles north of the subsurface front area where transitional waters with surface salinities of 34.60-34.70 percent overlayed a tongue of North Pacific Central Water located at depths centered at about 130 meters (427 feet) with salinities of 35.05-35.06 percent.

A total of 5 long-line stations using 60 baskets of 6-hook gear were occupied along longitude 158° 00' W. while headed south to locate the subsurface front; 5 stations were made in the front area and 5 were made in the area fished by the cooperating long-liners. A total of 45 big-eyed tuna (28-205 pounds), 37 striped marlin, 2 white marlin, 11 shortnosed spearfish, 31 dolphin, 74 great blue shark, 11 thresher shark, 3 whitetip shark, 2 mako shark, 30 lancetfish, 9 sting ray, 6 wahoo, 5 skipjack tuna (14-18 pounds), and 7 yellowfin tuna (87-127 pounds) were caught. The results showed that there were more apex predators caught in the subsurface front area than were caught in the area fished by the local long-liners. Of significant abundance in the front area were the dolphin and shark. The catch of big-eyed tuna in the front area was only slightly better than that made in the area of the long-liners.

A total of 41 big-eyed tuna blood samples was collected and preserved.

Other activities of the cruise included: standard weather observations; daily thermograph records and barograph records were kept; 5 skipjack blood samples were collected and preserved; 3 sting ray were preserved for identification; 1 yellowfin tuna and 1 big-eyed tuna were chilled and 9 big-eyed and 3 yellowfin were frozen for physiological studies.

A total of 18 surface plankton tows (30 minutes each) was taken each night; incidental surface trolling was conducted when traveling between fishing stations and en route to Honolulu; weight, length, and sex of all tuna and the weight and sex of the marlin were recorded; and the stomachs of marlin and dolphin were examined for juvenile tuna whenever possible.

Note: See Commercial Fisheries Review, June 1966 pp. 9 and 10.

Columbia River

SHAD NETTING ACTIVITIES DURING 1966 SEASON:

With the Columbia River closed to gillnetting of salmon to protect the summer chinook and sockeye runs, both the Oregon Fish Commission and the Oregon State Police received numerous calls in regard to netting activities along the river, said that State's Fisheries Director. Behind the inquiries was the fact that the shad season was open for commercial fishermen, he pointed out.

Under regulations set cooperatively with the Washington Department of Fisheries, the shad season runs from noon May 26 to noon June 25 in area 1-S (vicinity of St. Helens to near Corbett) and from noon May 26 to noon July 15 in area 2-S (near Corbett to the usual commercial fishing deadline 5 miles below Bonneville Dam). During these seasons, there is a 30-hour weekly closure each week from noon Saturday to 6:00 p.m. Sunday. The Fisheries Director emphasized that because of mesh size, strength, and design of the nets, relatively few salmon and steelhead are taken in the shad fishery. Those that are caught must, by regulation, be immediately returned to the river. The special shad season is set to allow harvest of this abundant species while at the same time protecting the salmon. Studies conducted last year showed that similar regulations satisfactorily accomplished that objective. Although some salmon were taken in the shad nets, most were alive and were returned to the river.

Shad were introduced into the Columbia River and also in the Sacramento River in California during the late 1800's. They increased rapidly and became established in various other coastal streams. Columbia River shad numbers have been high during recent years, and in 1965 a record 617,000 passed over the fish ladder at Bonneville. Many others spawned in the mainstem Columbia below the dam, especially in the Washougal Reef area.

Despite the excellent flavor of the meat, the fish has not found widespread favor locally because of its multitude of fine bones but it is popular on the East Coast. Shad roe, the clusters of tiny eggs, is the most valuable product of the shad fishery.

In past years, Columbia River shad landings have been as high as 1.4 million pounds for the season. "Shad catches have been good thus far this season. With the runs apparently on the increase and with greatly improved marketing prospects, it appears that the shad is going to occupy a position of major importance in Oregon's valuable food fish fishery," the Oregon Fisheries Director said. (Oregon Fish Commission, June 24, 1966.)

Connecticut

FEDERAL GRANT TO AID OYSTER INDUSTRY:

A $200,000 grant to the State of Connecticut was approved in June 1966 by Secretary of the Interior Stewart L. Udall to help restore and put back into production oyster grounds in that State which were severely hit when oysters were killed by drought conditions.

Drought-caused damage reached a climax in 1965 with a total failure of oyster seed resources. Without a natural "set" of seed oysters in 1965, the Northeast faces the possibility of no marketable oysters for the 1968-69 period unless immediate steps are taken to remedy the situation.

Since the drought and the failure of oyster set were due to natural causes, the State qualifies for assistance under provisions of a Federal fishery disaster relief law passed in 1964. The law is administered by Interior's Bureau of Commercial Fisheries, and provides that the Secretary may make available up to $400,000 to aid a fishing industry when a resource disaster occurs.

The drought disrupted large areas of oyster habitat by causing increased salinity and altering temperatures, according to Bureau scientists. The reduced fresh-water runoff also affected the food supply, protection from predators, and necessary movement of oyster larvae.

Federal assistance will be supplemented by at least $150,000 of State funds in efforts to restore the industry which once brought oystermen and processors $10 million annually. The Federal and State money will be used to plant spawning oysters and finance related operations.

Note: See Commercial Fisheries Review, December 1964 p. 118.

Federal Aid for Sport Fish and Wildlife Restoration

INTERIOR APPORTIONS FUNDS TO STATES FOR FY 1967:

Federal-aid funds totaling $18,275,000 for fish and wildlife restoration projects were distributed on July 1, 1966, to the 50 states, Guam, the Virgin Islands, and the Commonwealth of Puerto Rico, announced Secretary of the Interior Stewart L. Udall.

The distribution of funds, $3,275,000 greater than a similar distribution the previous year, was a preliminary apportionment to help states (with small reserve funds) finance Federal-aid operations between July 1 and the final apportionment for the year which comes in the fall, the Interior Secretary said.

Of the $18,275,000 allocated, $14,675,000 is for wildlife restoration and $3,600,000 is for sport fishery projects.

Fish and wildlife restoration funds come from Federal excise taxes collected from manufacturers, importers, and producers of firearms, fishing rods, and other types of hunting and fishing equipment. Under the Federal aid programs, states spend their own funds on approved projects and are then reimbursed for up to 75 percent of the cost. The laws establishing those programs also provide $10,000 each for Guam, the Virgin Islands, and the Commonwealth of Puerto Rico. The total 1967 fiscal year apportionments for those areas are included in the funds distributed on July 1.

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

Note: See Commercial Fisheries Review, August 1965 p. 34.

ederal Purchases of Fishery Products

EPARTMENT OF DEFENSE
URCHASES, MAY 1966:

Fresh and Frozen: The Armed Forces are major buyer of fresh and frozen fishery roducts. Purchases of fresh and frozen fishry products for the Armed Forces in May 966 totaled about 2.8 million pounds with a alue of $2.1 million. This represents an imortant market for the U. S. fishing industry.

Canned: Tuna and sardines were the main canned fish items purchased for the Armed Forces in May 1966.

Notes: (1) Armed Forces installations generally make some local purchases not included in the data given; actual total purchases are higher than shown because data on local purchases are not obtainable.

(2) See Commercial Fisheries Review, July 1966 p. 23.

Source: U.S. Department of Defense, Defense Personnel Support Center, Philadelphia, Pa.

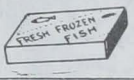


Table 1 - Principal Fresh and Frozen Fishery Products Purchased by Defense Personnel Support Center, May 1966 with Comparisons

Product	May				April				Jan.-May	
	1966		1965		1966		1965		1966	1965
	Qty. Lbs.	Avg. Cost ¢/Lb.	Qty. Lbs.	Avg. Cost ¢/Lb.	Qty. Lbs.	Avg. Cost ¢/Lb.	Qty. Lbs.	Avg. Cost ¢/Lb.	Qty. Lbs.	Qty. Lbs.
imp:										
aw headless	116,600	123	118,000	100	49,920	119	109,000	99	340,900	503,800
peeled & deveined	251,958	163	138,700	137	201,700	161	89,500	143	667,922	547,860
breaded	406,650	108	431,650	85	217,900	110	297,600	86	1,580,917	1,659,170
molded & breaded	137,750	70	83,300	65	93,900	68	77,650	66	336,330	316,850
Total shrimp	912,958	119	771,650	94	563,420	122	573,750	95	2,926,069	3,027,680
allops	48,330	46	202,000	67	139,800	46	90,900	76	1,052,380	831,784
ysters:										
Eastern	48,750	134	60,160	94	38,836	130	39,120	99	249,342	306,770
Pacific	9,000	91	71,090	81	17,210	90	14,912	81	147,640	183,654
Total oysters	57,750	127	131,250	87	56,046	118	54,032	94	396,982	490,424
illets:										
Cod	40,350	37	37,000	29	25,300	39	32,000	34	138,800	225,270
Flounder	243,500	44	214,500	33	211,550	41	246,700	39	1,425,350	1,263,700
Ocean perch	424,320	35	377,000	28	315,975	35	362,250	30	2,049,395	1,747,540
Haddock	107,200	37	167,850	37	96,700	36	138,000	33	788,000	761,400
addock portions	523,047	51	195,700	43	381,540	48	177,000	44	1,729,513	870,754
eaks:										
Halibut	95,920	57	125,560	49	110,200	57	52,800	50	506,420	500,780
Salmon	11,080	86	18,005	71	13,820	78	10,960	69	66,447	61,705
Swordfish	-	-	150	59	-	-	500	56	500	1,910

Table 2 - Fresh and Frozen Fishery Products Purchased by Defense Personnel Support Center, May 1966 with Comparisons

Quantity						Value					
May		April		Jan.-May		May		April		Jan.-May	
966	1965	1966	1965	1966	1965	1966	1965	1966	1965	1966	1965
(1,000 Lbs.)						($1,000)					
807	2,591	2,253	2,029	12,594	11,298	2,098	1,627	1,602	1,225	8,524	7,178

Table 3 - Canned Fishery Products Purchased by Defense Personnel Support Center, May 1966 with Comparisons

Product	Quantity						Value					
	May		April		Jan.-May		May		April		Jan.-May	
	1966	1965	1966	1965	1966	1965	1966	1965	1966	1965	1966	1965
	(1,000 Lbs.)						($1,000)					
una	257	1,161	-	315	1,078	3,671	468	526	-	142	954	1,609
almon	1	2	1	1	2,071	11	1	2	1	1	1,384	10
ardines	200	106	13	70	445	322	87	30	27	21	245	140

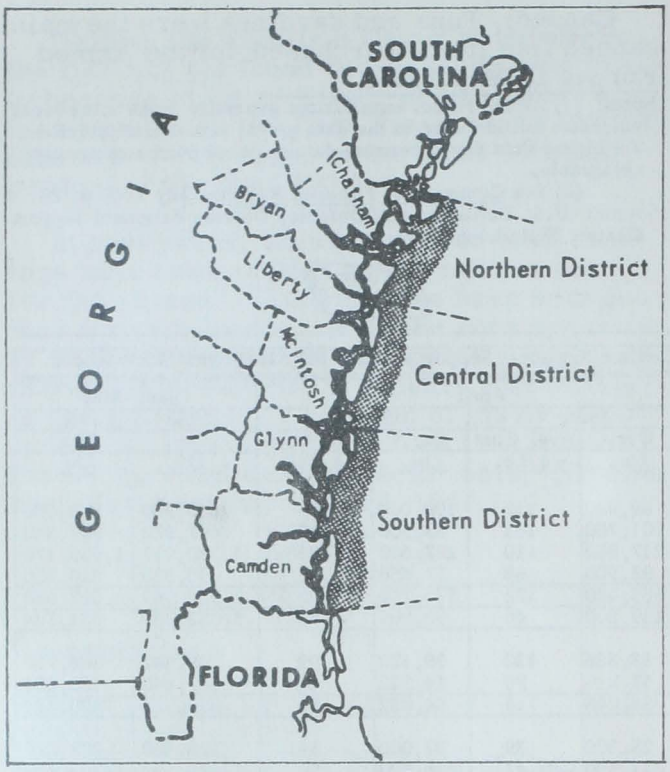
In May 1966 purchases of fresh and frozen ishery products for the Armed Forces were p 24.6 percent in quantity and 31.0 percent in alue from the previous month. The increase as due mainly to much larger purchases of hrimp, ocean perch, and haddock portions.

Compared with the same month in the previous year, purchases in May 1966 were up 8.3 ercent in quantity and 28.9 percent in value. verage prices were generally higher in May 966 as compared with the same month in 1965.

Georgia

FISHERY LANDINGS AND TRENDS, 1965:

Landings of fish and shellfish at Georgia ports during 1965 totaled 20.1 million pounds valued at $4.1 million. Compared with 1964 this was an increase of 9 percent in quantity and 39 percent in value. Production of shrimp was up 2.6 million pounds (heads-on weight) while blue crabs were down 1.3 million pounds; 94 percent of the year's total catch was made up of these two varieties of shellfish.



Fishing districts of Georgia.

Georgia's shrimp landings during 1965 amounted to 8.5 million pounds (heads-on weight) an increase of 45 percent above 1964, and 15 percent above the 5-year average (1960-1964). The average ex-vessel price per pound (heads-on weight) for shrimp during 1965 was 40 cents a pound, about 1 cent more than in the previous year. The size composition of the catch affected the overall average ex-vessel price per pound. During 1964, the 21-30 count size accounted for 33 percent of the catch, 31-40 count for 38 percent, and 41-67 count for 26 percent. This changed during 1965--the larger size (21-30) count dropped to 24 percent, medium size (31-40) count dropped to 35 percent, and the smaller size (41-67) count increased to 36 percent of the catch.

Blue crab landings totaled 10.3 million pounds--11 percent lower than in 1964. Ex-vessel prices for crabs taken by otter trawl varied from 3-6 cents a pound. Crabs taken by other types of gear, such as pots, traps, dip nets, or bait trot lines brought prices from 4-7 cents a pound.

Oyster production in 1965 totaled 247,698 pounds of meats, an increase of 26.5 percent from 1964.

Finfish landings in Georgia showed considerable improvement during 1965. The total catch of those species used for human consumption amounted to 816,000 pounds, an increase of 298,000 pounds above the 1964 catch. Of the major species of food, finfish and king whiting showed the greatest increase--253,000 pounds compared with 91,000 pounds landed the previous year. Flounder and fresh-water catfish landings also increased substantially from 1964.

Great Lakes

MICHIGAN OUTLINES FISH MANAGEMENT GOALS:

Michigan's commercial fishing interests figure prominently in the State of Michigan Conservation Department's ambitious new program to develop the Great Lakes into the world's greatest fresh-water fishery. That assurance is spelled out in a policy statement recently drawn up by the Department which outlines its goals and guidelines for fish management in those waters.

In explaining the newly drafted policy, the Department's fisheries chief reported, "Our broad goal is to manage the Great Lakes for maximum development of both sport and commercial fishing. There is room for both, and there is no reason to predict at this time that one must be sacrificed for the other."

The fisheries chief noted, however, that "development of the sport fishery must be our primary management goal when there is a choice to be made." He referred to where the emphasis should be placed if conflicts arise between sport and commercial fishing interests in some parts of the Great Lakes.

While sport-fishing interests will draw first consideration to produce the greatest recreational and economic returns where conflicts occur, the Department's overall program is geared to rebuilding a "profitable and progressive commercial fishing industry," the fisheries chief stressed. He said there is good reason to believe that both kinds of fishing can be vastly expanded in the Great Lakes where "we face our greatest fisheries management challenge and our greatest opportunity."

"Introduction of predatory species such as the coho (silver) salmon, which will feed on the trash fish that now dominate the lakes, will benefit both sport and commercial interests. Although those species will be primarily for sportsmen to harvest, their predatory influence will help create conditions favorable to commercial species as well," he explained. (News Bulletin, Michigan Department of Conservation, Lansing, May 26, 1966.)

* * * * *

MICHIGAN PROVIDED WITH SPLAKE BROOD STOCK FOR LAKE HURON PLANTINGS:

Approximately 6,000 "super" splake fingerlings were flown to Teal Lake near Ishpeming, Mich., this past June by Canada's Ontario Department of Lands and Forests to provide brood stock for fish plantings in Lake Huron in 3 or 4 years, according to the Michigan State Department of Conservation.

The tiny fish, a highly selective strain of the lake trout and brook trout, were taken to the State of Michigan's Marquette fish hatchery where they will be raised to spawning size. Young splake reared from the future brood fish will then be planted in Lake Huron, starting in 1969 or 1970. By that time, it is expected that chemical treatment work in Lake Huron streams will have made enough progress to give the planted fish a relatively good margin of safety from sea lamprey predation. The first-round fight to control lampreys in the lake's problem tributaries was opened this spring.

The splake were specially perfected by the Canadian government agency to provide planting stock for Lake Huron which will enjoy high survival and reproduce several years earlier than lake trout.

Under a joint program to be carried out by the Ontario agency and Michigan Department of Conservation, this variety of splake will be used exclusively for restoration plantings in Lake Huron. Tentative plans call for annually stocking the lake with several million of the fish for at least 6 years.

Ontario and Michigan fisheries officials consider the splake to be much better adapted to rehabilitating Lake Huron than the lake trout which are being planted in Lakes Superior and Michigan in large numbers.

"We have been experimenting on selective strains of splake for about 10 years and this latest variety to be raised as brood stock here and in Michigan is superior to the other ones we have developed," reported the supervisor of fisheries research for the Ontario Department.

"These fourth and fifth generations of selective fish are specially adapted for deep swimming and therefore will occupy waters of Lake Huron where the lake trout formerly lived," he added. The fish have also been developed for early maturity and reach a spawning stage in 2 or 3 years. By contrast, lake trout do not mature until they are seven years old.

"This means," said the supervisor of fisheries research, "that our planting efforts will be less expensive than they would be with lake trout." Compared with lake trout, fewer separate age classes of splake will have to be planted to insure sustained reproduction of the fish, he explained.

Ontario and Michigan fisheries officials are highly optimistic that the splake planting program will be a big success. (News Bulletin, Michigan Department of Conservation, Lansing, June 2, 1966.)

Great Lakes Fisheries Explorations and Gear Development

SEASONAL DISTRIBUTION AND ABUNDANCE STUDIES OF ALEWIFE AND CHUB IN LAKE MICHIGAN CONTINUED:

M/V "Kaho" Cruise 32 (May 2-20, 1966): To determine the distribution and measure the relative abundance of alewife and chub stocks, which provide raw material for new pet food and animal food manufacturers, was one of the objectives of this cruise by the exploratory fishing vessel Kaho. The vessel is operated by the Bureau of Commercial Fisheries, U. S. Department of the Interior.

Catches of alewife ranging from 3 tons in a 15-minute drag to 4 tons in a 1-minute drag verified the fact that this species is still on the increase in Lake Michigan and that only a small percentage of the areas yielding such catches are being used by commercial fishermen.

Fig. 1 - Alewife catch made by M/V Kaho in 15-minute drag inside Chicago Harbor.

Alewife landings increased from a few hundred pounds in 1956 to about 15 million pounds in 1965. Bureau of Commercial Fisheries investigations, closely associated with the industry during this period of growth, have furnished evidence of the great magnitude of the resource, of the almost year-around availability of alewife to otter (bottom) trawls, of the economic feasibility of producing alewife at a landed value as little as 1 cent a pound, and of the suitability of alewife for making high-quality pet food and fish meal.

Even with the 30-percent increase in alewife production expected again this year, the stocks available for harvesting will be hardly touched. According to the present condition and distribution of Lake Michigan alewife populations, a production of 200 million pounds a year is a reasonable goal.

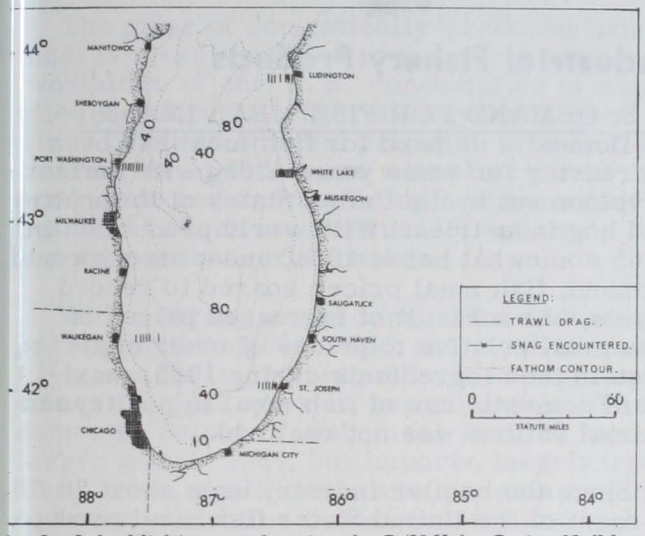
Continued Bureau research will maintain close surveillance of the alewife stocks, establish relationships to other important fish species, and strive to improve the economic utilization of this valuable resource.

Further evidence of the increasing numbers of alewife in Lake Michigan in spring 1966 came from such sources as municipal water supply systems, electricity generating utilities, and steel mills. Alewife plugged water intake screens more than ever this year--causing production cut-backs. One exception was the City of Chicago's Central District Filtration Plant, the largest facility of this type in the world, which experienced no difficulty even though large schools moved through the area for a period of about 5 weeks. A special deterent net, built according to Bureau recommendations, was set around the intake area and is credited with preventing serious problems during the alewife runs.

The primary objective of the cruise was to supplement data on the seasonal availability and bathymetric distribution of alewives, chubs, yellow perch, and smelt. Secondary objectives were to collect fish for botulism studies, monitor the growth rates and distribution of newly-planted lake trout, collect depth-frequency data on chubs, alewife, and perch, and collect fish for food studies.

Fig. 2 - Chicago Central District Filtration Plant which supplies water to 2.5 million Chicagoans. Faint white streak near shore at left is the air bubble curtain in operation--used to prevent alewife plugging of water intake screens.

A total of 44 drags was completed with a 2-food (headrope) fish trawl in southern and entral Lake Michigan. All drags were of 30 inutes duration except 16 which were shortned due to large catches and one which agged on a bottom obstruction. Bottom topraphy and fish concentrations were continusly monitored and recorded with a high solution echo-sounder.



g. 3 - Lake Michigan explorations by R/V Kaho Cruise 32 (May 2-20, 1966).

Very good catches of alewife were taken in of the 6 areas checked as follows: 8,000 ounds in 1 minute in the entrance piers at ort Washington; 1,800 pounds in 15 minutes 20 fathoms off Waukegan; 6,350 pounds in minutes inside Chicago Harbor; and 3,100 ounds at 5 fathoms off Benton Harbor. None those areas are being fished by commercial shermen. Best catches of alewife off White ake and Ludington were only 150 and 650 ounds, respectively. Chubs were taken in gnificant quantities between 25 and 40 fathms off Waukegan and Ludington only.

Fishing (bottom) temperatures during the ruise ranged from 37° to 44° F.

ote: See Commercial Fisheries Review, July 1965 p. 27.

Great Lakes Fishery Investigations

IOLOGICAL RESEARCH AND EA LAMPREY CONTROL, MAY 1966:

Some of the highlights of Great Lakes biological research during May 1966 by the Biological Laboratory at Ann Arbor, Mich., operated by the Bureau of Commercial Fisheries:

Sea Lamprey Control: The mid-season returns of spawning-run sea lampreys at the assessment barriers on Lake Superior were most encouraging in May 1966 since a 50-percent reduction from the previous 4-year low level was becoming evident. The total catch of sea lampreys at the end of May was 2,301, compared with 5,275 lampreys a year earlier. Optimism was running high because a significant decline occurred in the Brule River where 81 sea lampreys had been taken as of that time, compared with 2,838 a year earlier. The catch from the 3 index barriers on tributaries of northern Green Bay also showed a decrease. A total of 786 sea lampreys was taken compared with 2,158 at the same time in 1965. The Ocqueoc River barrier located in northern Lake Huron captured 673 lampreys, compared with 871 a year earlier.

Chemical treatment of lamprey-producing streams progressed rapidly during May. Initial treatments were completed on the 5 remaining sea lamprey streams in Lake Michigan. They were the Galien River, Donns Creek, State Creek, Trail Creek, and Burns Ditch, all tributaries along the south shore of the lake.

Completion of the scheduled treatment of Lake Superior streams during fall 1965 has allowed the laboratory's Marquette chemical unit to gain ground on next fiscal year's schedule in Lake Huron. With the approval of the Great Lakes Fishery Commission, 9 lamprey-producing tributaries of northern Lake Huron were treated for the first time.

Lake Michigan Research: The Laboratory's research vessel Cisco completed a biological cruise on May 31 in southeastern Lake Michigan. One of the principal objectives of the cruise was to fish for alewife and yellow perch larvae and to collect alewives from perch spawning grounds. Collections of other species and crustaceans also were made to provide material for laboratory studies.

Yellow perch began spawning in May off Saugatuck, Mich., at the termination of the cruise. However, about half of the mature females had spawned in the vicinity of Michigan City, Ind. Examination of stomachs from alewives taken from the perch spawning grounds revealed no perch eggs.

Preliminary information from laboratory feeding experiments designed to determine food preferences of lake trout indicated an apparent dislike for alewives. Lake trout from

a hatchery source, weighing 3 to 5 pounds, quickly caught and killed adult alewives, but did not swallow them. The lake trout readily ate freshly-thawed chunks of chubs (bloaters), but refused similar pieces of alewives. Essentially the same preference for bloaters was shown when the chubs and alewives were fed in freshly ground "soft pellet" form.

Reservoir Research: Three trap nets were fished during May 1966 in the Mobridge area of South Dakota and catches were good. Some 400 fish were caught per trap day, compared with 193 in the spring of 1964 and 166 in the spring of 1965. That was an increase of 33 percent by numbers and 10 percent by weight over high catches of previous years. More catches would have been possible except high winds reduced the frequency of lifts. Catch composition and relative species abundance showed little change over previous years although crappie and burbot were more abundant. Buffalofish of the 1962 year-class comprised about 75 percent of the total weight of fish caught. About 2,000 buffalofish of the 1962 year-class were tagged in the Mobridge area. Biological samples were routinely collected from all species caught in trap nets.

Commercial fishermen removed 101,000 pounds of fish during May--a decrease of 10 percent below the catch made during the same period a year earlier. Fishing effort was confined primarily to the embayments of the Moreau and Grand Rivers. Thirty percent of the buffalofish catch in numbers was of the 1962 year-class.

Lake Erie Research: The first major biological collection of sheepshead was made during May in western Lake Erie. Some 1,500 fish (1.5 tons) were taken in a single trap net lift and the total catch was processed for biological data.

The Bureau's research vessel Musky II conducted routine operations in the western basin, servicing recording thermographs and sediment collectors. The annual spring trawl sampling in East Harbor was completed to determine the state of juvenile fish populations.

Lake Superior Research: Another of the Bureau's research vessels, Siscowet, operated in the Apostle Islands area during the month determining the abundance and distribution of lake trout. A total of 911 lake trout was caught, of which 99 percent were finmarked fish. The abundance of lake trout was generally higher than for the same period a year earlier. The lake trout catch records of the assessment fishermen in the State of Michigan waters of Lake Superior for the month of April showed improvement over the previous year.

Industrial Fishery Products

U. S. DEMAND FOR FISH MEAL IN 1965: Domestic demand for fish meal has been increasing for some years along with the fast development in the United States of the poultry and hog industries. With world production in 1965 somewhat below 1964, and a strong world demand, fish meal prices soared to record levels. As a result of increased prices of fish meal relative to prices of other high-protein feed ingredients during 1965, maximum domestic use of fish meal in poultry and animal rations was not realized.

Since the broiler industry uses about 70-75 percent of the United States fish meal production and imports, that industry is the best demand indicator for fish meal. During 1965, the U. S. broiler industry continued to grow largely because red meat production was down about 4 percent. As a result, red meat prices increased considerably during the year. Because of a short production period, the broiler industry was able to increase output fast in response to high prices, and was thus able to benefit by lower red meat production.

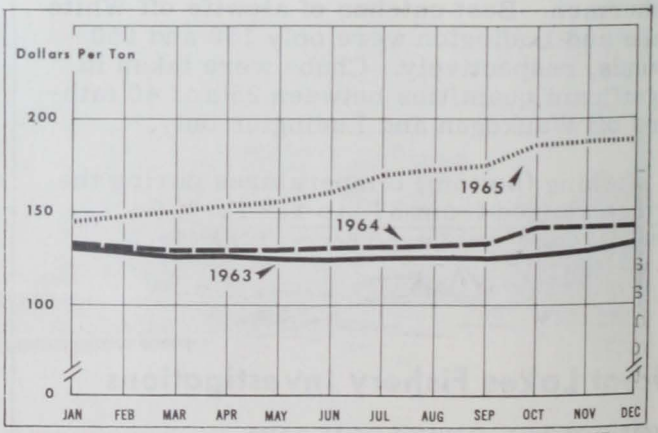


Fig. 1 - Average monthly menhaden meal prices, 1963-65.

While U. S. broiler production, and also the potential demand for fish meal increased in 1965, the utilization of fish meal did not increase because of (1) lower world supplies,

(2) greater fish meal demand in Europe, and (3) the resulting high price levels.

The rapidly increasing price levels of fish meal during 1965 caused greater substitution of other feed ingredients in broiler rations. Some feed producers completely eliminated fish meal in broiler rations while others decreased its use significantly.

The price of domestically-produced fish meal is closely related to the world price as two-thirds of the U. S. consumption is supplied by imports. The underlying factors which caused fish meal prices to soar to record heights in 1965 were a smaller world production and an increasing demand which resulted in keen competition for available supplies in the world market.

With a strong world demand for fish meal prevailing throughout 1965, and smaller quantities available, prices of both foreign and domestic meal rose to record levels. The domestic output of fish meal in 1965 was larger than in 1964, but imports, largely from Peru, were significantly smaller as a result of lower production in that country and high European prices.

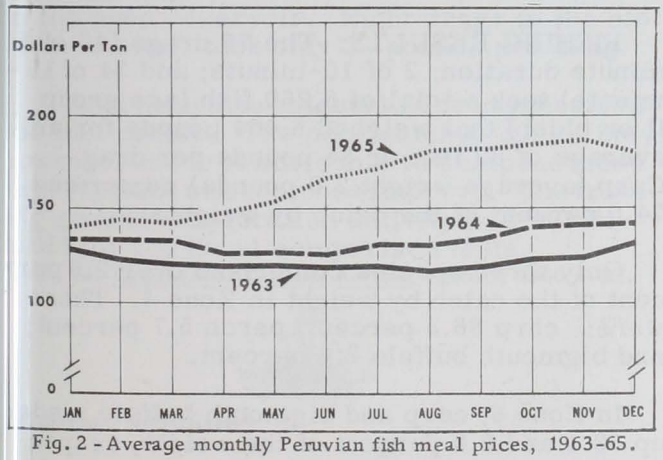


Fig. 2 - Average monthly Peruvian fish meal prices, 1963-65.

Domestic fish meal prices opened in January 1965 about $10-$12 a ton above a year earlier but failed to drop seasonally when the menhaden fishery started in April. Prices of both foreign and domestic fish meal rose steadily throughout the year to levels significantly above a year earlier and closed at record prices of $180-$186 a ton in December--about $40-$45 above a year earlier. (U. S. Bureau of Commercial Fisheries, Branch of Current Economic Analysis, Industrial Fishery Products Section.)

* * * * *

U.S. FISH MEAL, OIL, AND SOLUBLES:

Production by Areas, June 1966: Preliminary data as collected by the Bureau of Commercial Fisheries, U. S. Department of the Interior:

U.S. Production1/ of Fish Meal, Oil, and Solubles, June 1966 (Preliminary) with Comparisons

Area	Meal	Oil	Solubles
	Short Tons	1,000 Pounds	Short Tons
June 1966:			
East & Gulf Coasts	31,414	33,966	13,938
West Coast 2/	2,507	332	1,458
Total	33,921	34,298	15,396
Jan.-June 1966 Total	72,696	60,439	31,936
Jan.-June 1965 Total	98,809	77,244	35,524

1/Does not include crab meal, shrimp meal, and liver oils.
2/Includes American Samoa and Puerto Rico.

* * * * *

Production, April 1966: During April 1966, a total of 5,429,000 pounds of marine animal

Table 1 - U. S. Production of Fish Meal, Oil, and Solubles, April 1966 1/with Comparisons

Product	April		Jan.-Apr.		Total
	1/1966	1965	1/1966	1965	1965
	(Short Tons)				
Fish meal and scrap:					
Herring	574	236	883	1,275	12,859
Menhaden 2/	4,535	7,305	5,090	7,468	175,838
Tuna and mackerel	3,184	1,748	9,362	7,222	25,410
Unclassified	1,566	1,492	4,285	2,997	27,984
Total 3/	9,859	10,781	19,620	18,962	242,091
Fish solubles:					
Menhaden	1,559	2,147	4,213	2,147	74,405
Other	2,068	1,030	4,685	3,459	23,612
Total	3,627	3,177	8,898	5,606	98,017
	(1,000 Pounds)				
Oil, body:					
Herring	181	105	358	576	8,603
Menhaden 2/	4,529	9,603	4,660	9,698	175,368
Tuna and mackerel	431	239	1,257	1,083	4,799
Other (inc. whale)	288	205	802	504	6,864
Total oil	5,429	10,152	7,077	11,861	195,634

1/Preliminary data.
2/Includes a small quantity of thread herring.
3/Does not include a small quantity of shellfish and marine animal meal and scrap because production data are not available monthly.
Source: U. S. Department of the Interior, Bureau of Commercial Fisheries.

Table 2-U.S. Foreign Trade in Selected Industrial Products, April 1966 1/with Comparisons

Product	April		Jan.-Apr.		Total
	1/1966	1965	1/1966	1965	1965
	(Short Tons)				
Imports:					
Fish meal and scrap	39,526	39,721	113,642	134,909	270,666
Fish solubles	1,439	315	1,882	2,839	5,138
	(1,000 Pounds)				
Whale oil, sperm (crude and refined)	-	58	23,266	16,303	77,105
Exports:					
Fish and fish-liver oils	103	145	16,509	11,743	103,807
Whale and sperm oil	1,900	3,079	3,370	4,357	5,928

1/Preliminary data.
Source: U. S. Department of Commerce, Bureau of the Census.

oils and 9,859 tons of fish meal was produced in the United States. Compared with April 1965, this was a decrease of 4,723,000 pounds of marine animal oils and 922 tons of fish meal and scrap. Fish solubles production amounted to 3,627 tons--an increase of 450 tons as compared with April 1965.

* * * * *

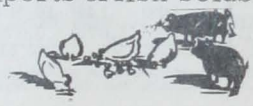
U. S. FISH MEAL AND SOLUBLES: Production and Imports, January-April 1966: Based on domestic production and imports, the United States available supply of fish meal for the first 4 months in 1966 amounted to 133,262 short tons--20,609 tons (or 13.4 percent) less than during the same period in 1965. Domestic production was 658 tons (or 3.5 percent) higher but imports were 21,267 tons (or 15.8 percent) lower than in January-April 1965. Peru continued to lead other countries with shipments of 71,200 tons.

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

Item	Jan.-Apr. 1966	Jan.-Apr. 1965	Total 1965
	. . . .(Short Tons). . . .		
Fish Meal and Scrap:			
Domestic production:			
Menhaden	5,090	7,468	175,838
Tuna and mackerel	9,362	7,222	25,410
Herring	883	1,275	12,859
Other	4,285	2,997	39,264
Total production	19,620	18,962	253,371
Imports:			
Canada	13,768	14,059	43,830
Peru	71,200	114,138	209,801
Chile	22,319	3,458	5,651
Norway	22	-	78
So. Africa Rep.	955	700	5,100
Other countries	5,378	2,554	6,206
Total imports	113,642	134,909	270,666
Available fish meal supply	133,262	153,871	524,037
Fish Solubles 1/:			
Domestic production	8,898	5,606	98,017
Imports:			
Canada	636	706	1,488
Iceland	33	-	-
Other countries	1,213	2,133	3,650
Total imports	1,882	2,839	5,138
Available fish solubles supply	10,780	8,445	103,155

1/Wet weight basis except for imports from South Africa Republic (included in "other countries").
Source: U. S. Department of the Interior, Bureau of Commercial Fisheries, and U.S. Department of Commerce, Bureau of the Census.

The United States supply of fish solubles during January-April 1966 amounted to 10,780 tons--an increase of 27.6 percent as compared with the same period in 1965. Domestic production of fish solubles increased 58.7 percent and imports of fish solubles decreased 33.7 percent.



Inland Fisheries Explorations and Gear Development

OAHE RESERVOIR TRAWLING STUDIES: Reservoir Research Vessel "Hiodon" Cruise 6 (May 1966): Another experimental trawling cruise was made in the Oahe Reservoir in South Dakota, located on the Upper Missouri River. Trawling operations by the reservoir fishery research vessel Hiodon, operated by the Department of the Interior's Bureau of Commercial Fisheries, were conducted in Zones 4, 5, 6, 7, 8, and 9 during May 1966.

FISHING OPERATIONS: A total of 76 drags was made with 35-, 45-, and 52-foot (headrope) trawls. The drags varied from 5 to 15 minutes duration and were made during daylight hours. Seven drags were incomplete due to fouling of the nets. No drags were attempted in Zone 5 as suitable areas were not located. One drag was attempted in Zone 7 but could not be completed. Also, an attempt to trawl in Zone 10 (Missouri River above the impounded water) was unsuccessful as it was not possible to proceed upstream beyond the Cannonball River in North Dakota.

FISHING RESULTS: The 76 drags (40 of 5-minute duration; 2 of 10-minute; and 34 of 15-minute) took a total of 6,260 fish (age group II or older) that weighed 6,404 pounds for an average of 82 fish or 84 pounds per drag. Carp (average weight 2.0 pounds) comprised 74.6 percent of the catch by weight.

Only three species comprised over 2.0 percent of the catch by weight in Zone 4. These were: carp 86.3 percent; perch 5.7 percent; and bigmouth buffalo 2.4 percent.

In Zone 6, carp and bigmouth buffalo made up 68.1 and 5.0 percent of the weight, respectively. In addition, drum made up 8.0 percent; carpsuckers 6.4 percent; goldeye 3.4 percent; and channel catfish 2.5 percent.

In the upper portion of the reservoir (Zones 8 and 9), the weight composition was: carp 51.6 percent; carpsucker 19.3 percent; shovelnose sturgeon 12.7 percent; goldeye 7.3 percent; bigmouth buffalo 2.9 percent; and sauger 2.5 percent.

A total of 419 yearling fish was taken--38 percent were white bass, 21 percent perch, and 17 percent goldeye. Also taken (in order

of decreasing abundance) were sauger, northern pike, white crappie, bullhead, walleye, black crappie, drum, channel catfish, burbot, carpsucker, and carp.

A "standard drag" had previously been of 15 minutes duration. Most of the 5- and 10-minute drags made during this cruise were in response to the strictly exploratory nature of many drags. Several small bays in lower Zone 6 and Zone 4 were tested for trawlability for the first time since the initiation of trawling on Oahe Reservoir. Some of these bays are not sufficiently long to accommodate 15-minute (approximately one mile) drags. In the fall of 1965, drags made on shallow flats were more productive than drags made in bays. During this cruise, however, the average bay drag took 151 pounds as compared to 41 pounds per drag on flats in the reservoir proper. This revised differential in rate of catch is probably associated with the warmer water temperatures in bays and behavior characteristics of the various species in response to this environmental condition. As a result, the 5-minute drags, many of which were made in bays, were about as productive (84 pounds per drag) as the 15-minute drags (89 pounds per drag), most of which were made over flats in the open reservoir. Eight drags in the old river channel took only 31 pounds per drag.

Trawl comparison tests had been scheduled for this cruise. The poor catches during May, however, made it advisable to postpone these experiments until catches improve. The trawling grounds exploration activity was substituted for the trawl comparison tests.

Note: See Commercial Fisheries Review, February 1966 p. 22.

Maine Sardines

QUALITY CONTROL PROGRAM FOUND EFFECTIVE:

The effectiveness of their mandatory quality control program was clearly demonstrated to Maine sardine canners at their annual spring meeting held June 9, 1966, in Ellsworth, Me. On display at the meeting were 130 open cans of various brands and types which were purchased in retail stores in 16 key markets on a national basis.

The Maine Sardine Packers Association president stated it was the consensus of those present that the overall quality and appearance were by far the best of any similar cutting in the past 15 years. "This certainly proved that our quality control program is working and was a great source of satisfaction for all concerned," he said.

Forty-two canners and their representatives attended the session and were briefed on congressional affairs, plant improvement and mechanization, the consumer market situation, and publicity and promotion. Also given was a briefing on Canadian government and industry plans to increase the herring fishery. (Maine Sardine Council, Augusta, Maine, June 9, 1966.)

National Fisheries Institute

ADVERTISING AND MERCHANDISING MANAGERS' CONTEST IS FEATURE OF 1966 "FISH 'N SEAFOOD PARADE":

The first contest of its kind sponsored by the United States fishing industry for advertising and merchandising managers of supermarkets (chains and independents) will be a feature of the 12th annual Fish 'n Seafood Parade during October 1966. An impressive array of prizes is to be given.

The fall Parade is aimed at increasing the sale of fishery products at a time when they are most plentiful, according to the chairman of the Fish 'n Seafoods Promotions Committee of the National Fisheries Institute (NFI).

Winners of the contest will be selected on the basis of the most effective and creative newspaper advertising of fish and seafood during October. Prizes will include a 1967 Ford Mustang, a two-week holiday in Europe, RCA color TV sets, portable TV sets and typewriters, record players, luggage, watches, major electric appliances, Instamatic cameras.

To make store advertising and merchandising managers throughout the United States aware of the Fish 'n Seafood Parade Promotion and the contest, a promotional brochure featuring the advertising themes of the fall Parade is being distributed.

Contest details and coordination of the program will be handled by the New York office of the J. Walter Thompson Co., the advertising agency for the National Fisheries Insti-

tute. Judges of the contest will be selected from the food trade.

To inform buyers of food eaten away from home of the goodness and abundance of fishery products, advertising will be directed to the mass-feeding market. A full-scale publicity campaign to acquaint all buyers of food with the benefits of serving fish and seafoods will be channeled through national and quantity-feeding magazines, newspapers, radio and TV programs.

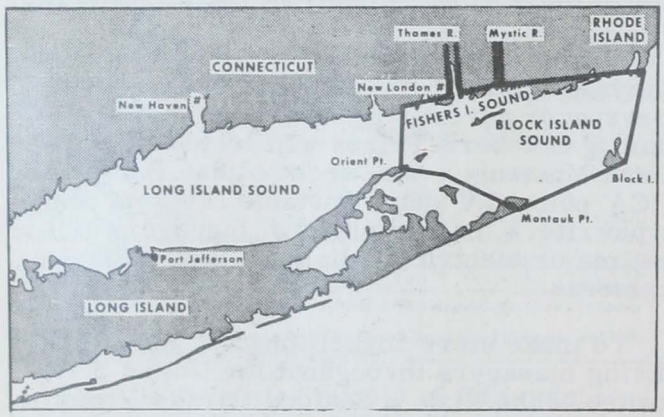
Area Fish 'n Seafood Parade committees are being formed. The committees of industry men will plan local publicity and advertising promotions to tie-in with the national campaign.

Note: Information about the trade contest and the national and local promotions may be obtained from the National Fisheries Institute, 1614 Twentieth St. NW., Washington, D. C. 20009.

Nautical Charts

NEW TIDAL CURRENT TABLES ISSUED FOR LONG ISLAND AND BLOCK ISLAND SOUNDS:

The publication of new tidal current tables of Block Island and Fishers Island Sounds and northeastern Long Island Sound, based on the most extensive survey in 36 years of the New York-Connecticut-Rhode Island area, was announced June 13, 1966, by the U. S. Department of Commerce.



Long Island and Block Island Sounds area covered by new tidal current tables shown in heavy black lines.

The new tables will provide the more than 450,000 recreational boaters, fishermen, commercial shippers, and engineers who frequent the area with the most up-to-date information available on the current behavior of this heavily-traveled waterway.

The new tables were incorporated in a pamphlet issued as a supplement to the 1966 Tidal Current Tables for the Atlantic Coast of North America, which were published in October 1965. Information in the supplement will subsequently be included in the 1967 Tidal Current Tables.

The supplement to the annual publication was published by the Coast and Geodetic Survey, an agency of the Environmental Science Services Administration (ESSA). It was issued in order to make the new data available in time for summer use by recreational and other boaters.

The supplement covers all of Block Island Sound, most of Fishers Island Sound, the northeastern section of Long Island Sound between Orient Point on Long Island and the southern Connecticut shore, and part of the Thames and Mystic Rivers in Connecticut. It was based on last year's survey, part of a 3-year project of the Coast and Geodetic Survey which will be completed in 1967. The entire survey will embrace the waters of Long Island Sound, Block Island Sound, Fishers Island Sound, and part of the Housatonic, Connecticut, Thames and Mystic Rivers.

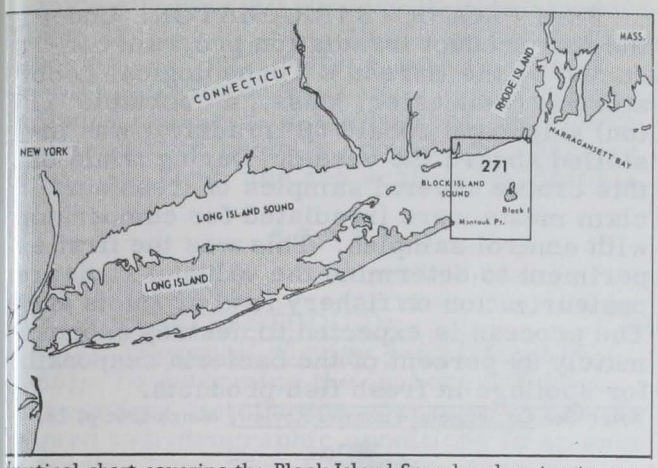
Free copies of the pamphlet can be obtained from the Survey's local sales agent or by writing to the Coast and Geodetic Survey at 602 Federal Office Bldg., 90 Church St., New York, N. Y. 10007, or at the Washington Science Center, Rockville, Md. 20852.

* * * * *

NEW CHART ISSUED FOR BLOCK ISLAND SOUND:

A new nautical chart covering a portion of one of the nation's busiest waterways--Block Island Sound and the east entrance to Long Island Sound--has been issued by the Coast and Geodetic Survey, an agency of the U. S. Department of Commerce's Environmental Science Services Administration (ESSA).

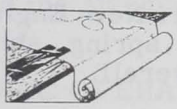
The large-scale chart (No. 271, scale of 1:40,000) will provide greater detail for the safe navigation of the area, which handles a heavy concentration of commercial and recreational boating, much of it to and from New York City. The chart will also be of great help to the more than 500,000 recreational craft from New York, Connecticut, Rhode Island, and Massachusetts, which frequent the area.



Nautical chart covering the Block Island Sound and east entrance to Long Island Sound (area indicated by the box).

A considerable portion of the approximately 150 million tons of waterborne commerce to the Port of New York passes through Long Island Sound and thence through the East River.

The new chart will be welcomed by fishermen of the area from Montauk Point to Block Island Sound, reputedly the best fishing locality between New Jersey and Massachusetts. A considerable amount of the 686 million pounds of fish and shellfish landed at New York, Connecticut, Rhode Island, and Massachusetts in 1965 was taken from that area.

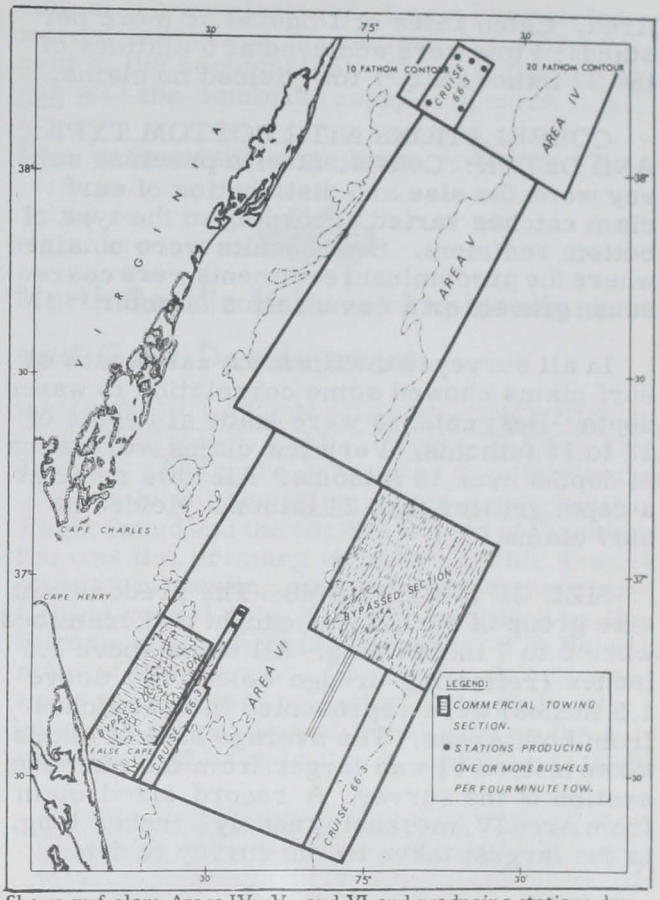


North Atlantic Fisheries Explorations and Gear Development

SURF CLAM SURVEY CONTINUED:

M/V "Delaware" Cruise 66-3 (April 29-May 13, 1966): Catches of surf clams (Spisula solidissima) by hydraulic jet dredge varied from none to 3.6 bushels per 4-minute (standard) tow, and from none to 3.8 bushels per 20-minute (simulated commercial) tow during a recent survey of the surf clam population off the Virginia, Maryland, and Delaware coasts. The exploratory fishing vessel Delaware, operated by the Bureau of Commercial Fisheries, U. S. Department of the Interior, completed a preliminary survey in the area off Virginia (Area VI) and continued earlier work off Maryland and Delaware (Area IV).

SURVEY PROCEDURES: The procedure used during previous surf-clam surveys was



Shows surf clam Areas IV, V, and VI and producing stations during M/V Delaware Cruise 66-3 (April 29-May 13, 1966).

followed during this cruise. Stations were located at 1-mile intervals along 1-mile spaced grid lines. A 48-inch hydraulic jet dredge was towed 4 minutes at each site with the exception of 64 commercial simulated tows for 20 minutes each in a preselected section of Area VI.

RESULTS IN AREA VI: Only 2 standard tows, located in the inshore section surveyed in Area VI, yielded catches of one bushel or more. Out of 221 standard tows completed in the Area, 89 yielded less than one bushel and 130 were unproductive. In the offshore section of Area VI only a few clams were taken at shallow water stations. Simulated commercial tows for 20 minutes were made at 64 stations in one section of Area VI; none of these yielded 4 or more bushels. Except for 2 sections (restricted navigation and reported unexploded mines), standard survey coverage was completed in Area VI.

RESULTS IN AREA IV: Surf-clam catches in the section surveyed in Area IV were better than expected, based on previous work in the

Area. Catch rates of 1 bushel or more per standard tow were achieved at 5 stations of the 37 fished; only 1 tow yielded no clams.

CORRELATIONS WITH BOTTOM TYPE AND DEPTH: Consistent with previous survey work the size and distribution of surf clam catches varied according to the type of bottom sediment. Best results were obtained where the predominant sediments were coarse sand, gravel, or a combination of both.

In all surveyed sections the catch rate of surf clams showed some correlation to water depth. Best catches were made at depths of 13 to 15 fathoms. Very few clams were taken at depths over 15 fathoms. All tows made at a depth greater than 24 fathoms yielded no surf clams.

SIZE OF SURF CLAMS: The predominant size group of surf clams caught and examined were 5 to 7 inches long. All sizes above 1.5 inches (reflecting dredge selectivity above 1.5 inches) were represented in the catches from both Areas. The average size of clams taken in Area VI was larger from the offshore section of the survey. A record sized clam from Area IV, measuring nearly 8 inches long, is the largest taken by the survey to date.

OCEAN QUAHOGS: Catches of ocean quahogs were very small and widely scattered in both Areas. The largest catch (30 quahogs) was made in the deeper offshore waters of Area VI.

UNDERWATER TV AND CLAM-SOUNDER WORK: The fishing operation of the dredge and views of the bottom were observed using a closed-circuit underwater TV system. Because of good water transparency, the action of the dredge knife, jet header and other component parts were seen clearly. Live surf clams in the bottom were not seen but other species of shellfish and fish were visible. Considerable movie film footage was obtained by photographing the shipboard TV monitor.

Trials were successfully accomplished with a redesigned clam-sounding system. Sounds transmitted by the sounder, while towing on bottom, were tape recorded as the device was viewed through the underwater TV system. Although no identifiable sound of a live clam was recorded other sounds relating to the dredging operation were recorded and identified.

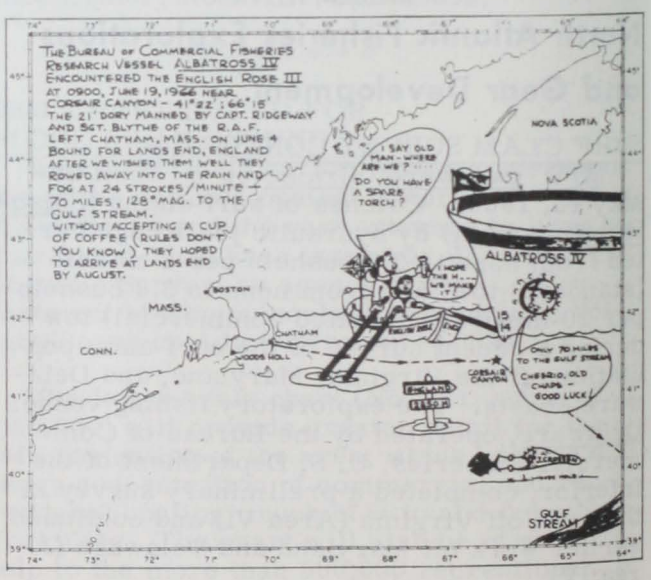
FISH PRODUCTS IRRADIATOR: Under the fish product irradiation program conducted by the Bureau's Technological Laboratory at Gloucester, Mass., a "portable" (17-ton) shipboard cobalt-60 irradiator was installed aboard the vessel. During trials on this cruise several samples of fresh surf-clam meats were irradiated for comparison with control samples. This was the first experiment to determine the value of radiation pasteurization on fishery food products at sea. The process is expected to destroy approximately 99 percent of the bacteria responsible for spoilage in fresh fish products.

Note: See Commercial Fisheries Review, March 1966 p. 28.

North Atlantic Fisheries Investigations

RESEARCH VESSEL "ALBATROSS IV" SETS RECORD FOR DAYS AT SEA:

The research vessel Albatross IV, operated by the Interior Department's Bureau of Commercial Fisheries, set a new record during the period July 1965 to June 1966. In all, 14 research cruises were carried out, totaling 232 days at sea. The bulk of the research was concerned with the distribution and abundance of groundfish in the Gulf of Maine and neighboring waters to the north (Scotian Shelf) and south (southern New England). The three cruises in early spring, summer, and fall, lasted 91 days overall.



Oceanographic surveys in the same area (4 cruises totaling 59 days) monitored the dy-

namics and secular changes in water masses. Three cruises by other Bureau laboratories, studying herring, lobsters, and acoustical problems occupied 44 days. Other cruises included research on the benthos, midwater distribution of juvenile groundfish, serology of groundfishes, and sea scallop populations.

* * * * *

DISTRIBUTION OF ZOOPLANKTON STUDIED:

M/V "Rorqual" Cruise 4-66 (May 17-26, 1966): To determine the inshore-offshore and vertical distribution of zooplankton with regard to hydrographic conditions in an area extending from Cape Ann to Machias Bay, Me., was the objective of this cruise by the research vessel Rorqual, operated by Interior's Bureau of Commercial Fisheries.

BIOLOGICAL OBSERVATIONS: Plankton tows lasting 15 minutes each using Clarke-Bumpus closing samplers in a vertical series 0, 10, 30, and 60 meters (0, 32.8, 98.4 and 196.8 feet), were made along 6 transects from inshore to the 100-meter (328 feet) isobath. Oblique tows from 0 to 20 meters (0 to 65.6 feet) and lasting 30 minutes each were taken using a Gulf III sampler at 8 coastal continuity stations and at 4 additional locations. Exploratory Clarke-Bumpus tows were made in Pleasant Bay and the Machias, Sheepscot, and Piscataqua Rivers.

HYDROGRAPHIC OPERATIONS: At each station: (1) a Nansen bottle cast was made to determine salinity at 0, 10, 20, and 30 meters and the bottom; (2) a bathythermograph (BT) cast was made to determine vertical temperature distribution; (3) water transparency was measured with a Secchi disc; and (4) meteorological observations were recorded. Five sea-bed drifters and 5 surface drift bottles were released at each station.

PRELIMINARY FINDINGS: The average concentration of zooplankton along the coast was not significantly different ($P>.05$) from the average station value obtained in spring 1965. However, the center of zooplankton abundance shifted from the western Gulf coast in 1965 to the central area this year. The average volume in the western area was 4 times lower than in 1965. As in previous years, the lowest areal volumes occurred in the eastern sector.

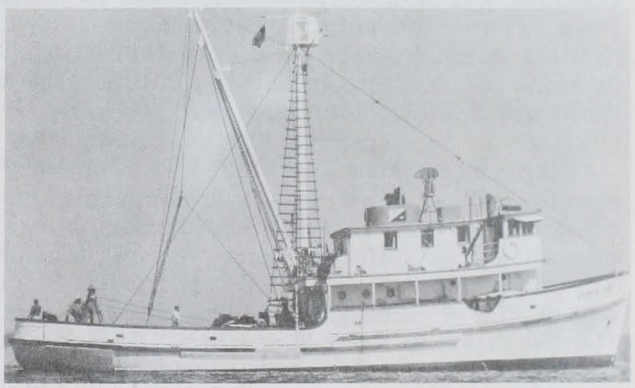
Copepods were the dominant zooplankters in the western and central Gulf coast (70 percent of the zooplankton). Larval barnacles were numerous in the eastern area (82 percent of the zooplankton). Calanus finmarchicus was the dominant copepod species in all areas.

Note: See Commercial Fisheries Review, April 1966 p. 29.

North Pacific Fisheries Explorations and Gear Development

HAKE POPULATION SURVEY CONTINUED:

M/V "John N. Cobb," Cruise 78 (May 13-June 10, 1966): To determine the distribution of schools of hake (Merluccius productus) in Puget Sound and the coastal waters of Washington was the primary objective of this 4-week midwater trawling cruise by the exploratory fishing vessel John N. Cobb, operated by the Bureau of Commercial Fisheries, U.S. Department of the Interior. Secondary objectives were to (1) obtain biological data on Pacific hake and (2) obtain additional data on the availability of hake to the "Cobb" pelagic trawl.



Bureau of Commercial Fisheries exploratory fishing vessel M/V John N. Cobb.

Echo-sounding transects were made to locate concentrations of hake and their availability was measured with the "Cobb" pelagic trawl. These transects were made throughout Puget Sound and in the coastal waters of Washington between 25 and 100 fathoms.

PUGET SOUND: Hake concentrations were located in Saratoga Passage, Port Susan to Port Gardner, Possession Sound, and Hood Canal. In Saratoga Passage the fish signs were sporadic and light and were mainly found along the western side of the Passage close to shore. Hake signs in Port Susan were more concentrated than those in Saratoga Passage and were found as far north as Kayak Point

in Port Susan to as far south as Port Gardner near Everett.

The best signs were found in Port Susan off the eastern shore of Camano Island in about 8 to 12 fathoms of water above the bottom depths of 58 to 64 fathoms. The fish signs were not considered heavy. At the time of the survey, the commercial trawler St. Janet was fishing these hake concentrations off the eastern tip of Camano Island and catching on the average about 6,600 pounds an hour. The John N. Cobb's average catch was about 8,300 pounds an hour in the same locality. This was based on 3 tows. The southern end of the Port Susan school was fished off Port Gardner where 3,000 pounds of hake an hour were caught.

Sporadic signs were encountered between Hood Canal and Port Gardner. A 20-minute tow, made on one of these signs off Possession Point, caught only 100 pounds of hake and 100 pounds of pollock.

Hake concentrations were found in Hood Canal off the eastern and southern shores of Toandos Peninsula and as far south as Tekiu Point. The echo returns from those fish were light to medium. The fish were from 10 to 20 fathoms off the bottom and the catch rate on them was 6,000 pounds an hour.

Dogfish (Squalus acanthias) was the only species of fish taken in any appreciable quantities with hake. In Port Susan about 2 to 15 percent of the catches consisted of dogfish. They were large fish (2 to 3 feet in total length) and of 52 fish examined, 25 had the remains of Pacific hake in their stomachs. In Hood Canal about 100 pounds of small dogfish (26 to 31 centimeters or 10.2 to 12.2 inches in total length) were caught with the 6,000 pounds of hake.

COASTAL WATERS OFF WASHINGTON: During the first two-thirds of the cruise off the coast of Washington (May 27 to June 5), fish signs were numerous but mostly sporadic from Destruction Island to the Columbia River. The only sizable and dense concentration of fish was found in the vicinity of the Russian fleet which was operating southwest of Willapa Bay. That school extended from off Klipsan Beach southward to Long Beach (a distance of about 7 to 8 miles) and was on the average about 2 miles wider. It was situated over bottom depths from 32 to 48 fathoms. The signs were 2 to 4 fathoms in thickness and were on or about 1 fathom off the bottom. The best signs were about 5 miles in length and 1 to $1\frac{1}{2}$ miles wide over bottom depths from 38 to 46 fathoms. This school was located and sounded on May 29.

A second and more northerly school was located northwest of Grays Harbor on June 3. Latitudinally the school extended from off the Queets River south to off Moclips, a distance of some 15 miles. The school was about 4 miles wide at its greatest width and was situated over bottom depths from 43 to 60 fathoms. The best signs were over bottom depths of 50 to 53 fathoms. However, the signs were mostly light and sporadic indicating that the fish were not formed into a compact school. Fishing this school yielded only 1,000 to 4,000 pounds of fish an hour.

During the latter third of the cruise off the Washington coast, hake signs were more numerous and in certain localities more dense than was observed earlier in the cruise. The school located off Klipsan Beach near Willapa Bay earlier in the cruise showed a much denser trace and when fished yielded from 8,000 to 12,000 pounds of hake an hour. Good hake signs were observed northwest of Cape Shoalwater but a one-hour tow on these signs caught only 6,500 pounds of hake. On the evening of June 8, a small but dense pocket of fish was located directly off the entrance to Grays Harbor over a bottom depth of 43 fathoms. These signs yielded 12,000 pounds of hake an hour. The school to the north between Moclips and the Queets River also showed an increase in the density of the signs when a number of sounding transects were made through it on June 9. A Soviet side trawler, which was fishing in the vicinity of these dense signs, was observed bringing aboard a catch of some 20,000 pounds of hake.

BIOLOGICAL OBSERVATIONS: Samples of Pacific hake taken in Puget Sound were smaller than those taken off the coast of Washington. Puget Sound hake ranged in size from 15 to 66 centimeters (5.9 to 26.0 inches) with a mode of about 35 centimeters (13.8 inches) whereas the coastal hake ranged in size from 38 to 70 centimeters (15.0 to 27.6 inches) with a mode of about 50 centimeters (19.7 inches).

A marked difference was found in the sex ratio between hake taken in Port Susan and those taken in Port Gardner and Hood Canal. In two of the hauls made in Port Susan the

sex ratios were 8 to 1 and 13 to 1 with males predominating. By contrast, those fish taken in Port Gardner and Hood Canal had a sex ratio of nearly 1 to 1.

The stomach contents of hake caught off the coast of Washington contained principally euphausids and occasionally anchovies.

In Puget Sound a strong continuous echo return from near surface water (5 to 15 fathoms) was encountered off Seattle and as far south as Case Inlet and Carr Inlet. A half-hour tow with the pelagic tow was made on those signs, but no organisms were taken. Subsequently, plankton tows made through these signs caught many ctenophores, which may explain the strong echo returns.

COOPERATIVE STUDIES: In cooperation with the Bureau's Seattle Technological Laboratory, a lot of Pacific hake was delivered to a reduction plant in Puget Sound for oil yield tests. Also, about 600 pounds of hake were iced at sea for delivery to the Seattle Technological Laboratory. The iced fish were to be used for quality tests to determine their use in fish blocks.

Note: See Commercial Fisheries Review, July 1966 p. 38.

Oceanography

STUDENT WORK-STUDY PROGRAM OF U. S. NAVAL OCEANOGRAPHIC OFFICE:

Fifty college students from across the Nation participated this summer (1966) in a work-study program of the U. S. Naval Oceanographic Office, Suitland, Md. On-the-job training takes place during collegiate vacations in support of formal studies conducted during the past scholastic year.

Students enter the summer training program at a grade level based on their previous academic progress. After successfully completing each period of on-the-job training, the students are granted leave to return to college. No salary is paid for the time a trainee is in college and each must defray expenses involved in their formal education. On completion of both on-the-job training and college education, a student is then eligible to join the Naval Oceanographic Office as a regular employee.

The program is geared toward assisting ambitious college students interested in oceanography to utilize their talents and training toward a challenging career. Young people studying oceanography, mathematics, chemistry, cartography, physics and engineering are given competitive examinations and those at the top are selected for the summer program.

Oregon

CHINOOK FINGERLING LIBERATION TIED IN WITH BONNEVILLE HATCHERY EXHIBIT:

Release into the Columbia River from the Oregon Fish Commission's Bonneville Hatchery of 5.5 million fall chinook fingerlings was scheduled for June 28, 1966, announced that State's Fisheries Director. The young fish, measuring $3\frac{1}{2}$ inches long, were reared at the hatchery for about 120 days. The liberation coincided with the opening of the Commission's new public exhibit at the Bonneville station. The exhibit incorporated the idea of the self-guided tour so popular in various parks and other places of historic or scenic appeal.

The Oregon Fish Commission plays host to about $\frac{1}{2}$ million visitors at Bonneville Hatchery each year. Although hatchery personnel may occasionally be available to answer questions by visitors, the Commission has felt the need for a good interpretive display that would give detailed information on hatchery operations as well as other phases of its activities without the visitor having to look up someone to answer his questions.

The new public display included 7 major points of interest located at different places throughout the hatchery grounds. Since a visitor to this or any other hatchery cannot hope to see at any particular time of the year all of the seasonal activities that are connected with modern fish culture, the Bonneville display attempts to fill the gap by explaining what activities take place at each particular locale, when it takes place, and its role in the overall activity of the hatchery.

"We look at the opening of the Bonneville self-guided tour as the unveiling of an important new recreational and educational attraction," the Fisheries Director said. Modern concepts of color and form have been used freely to give even wider appeal to an interesting and important conservation story.

Although the new display will add greatly to the visitor's enjoyment of a trip to Bonneville Hatchery, the facility still remains essentially an important salmon production station rather than merely a recreational tour attraction, it was emphasized. Bonneville Hatchery is one of 15 operated by the Oregon Fish Commission in the Columbia River system and on various coastal streams.

The Bonneville station is financed in part by the Federal Government under terms of the Columbia River Fishery Development Program and is to provide, at least in part, mitigation for damage to the Columbia River runs by construction of dams in the river system.

About 5.5 million fall chinook and 1.5 million young coho salmon are liberated each season into the Columbia River at the hatchery. Returns of adult fish to the station have been increasing each year and tagging studies have shown Bonneville fish make a substantial contribution to both sport and commercial fisheries offshore as well as in the Columbia River.

Adults from the 5.5 million fall chinook which were released in June will return to the hatchery stream on their spawning run mainly as 3- and 4-year old fish with a scattering of 5-year olds and some 2-year old jacks. "We now have at the Bonneville Hatchery a display which we feel will make a tour of the facility an enjoyable and worthwhile experience," the Fisheries Director said. "The grounds are open every day and we encourage everyone who is interested in Northwest fish and conservation to plan to visit the Bonneville Hatchery in the near future." (Oregon Fish Commission, June 24, 1966.)

* * * * *

SALMON SPAWNING AREAS OPENED BY REMOVAL OF DAM:

Removal of Dee Dam on the East Fork of Hood River has made at least 40 miles of spawning and rearing area on both the East and Middle Forks readily available to salmon and steelhead, the Oregon Fish Commission reported. Prior to a complete block to upstream passage caused by the flood in 1964, there had been some use of upstream spawning areas by anadromous fish, mainly steelhead, but passage over the inadequate fishway at Dee Dam had been of concern to the fishery management agencies for many years.

Dam construction, water diversions, industrial developments and other demands have continually reduced the Columbia River system's available spawning and rearing areas over the years. For this reason, opening the East and Middle Forks of Hood River to ready access by anadromous fish is especially significant.

Although both coho and chinook salmon as well as steelhead have utilized the spawning and rearing areas on the East and Middle Forks, the runs of those species were termed remnant by the project leader of the Commission's Columbia River watershed development program. One of the main reasons for the reduced salmonid runs is the long-term inadequate passage at Dee Dam.

The Hood River system, typical of those of glacial origin, is subject to periods of high runoff and resultant scouring of the streambed. Despite this situation, the East and Middle Forks have a considerable quantity of good spawning and rearing area for anadromous fish. Experimental releases of marked coho fingerlings have resulted in encouraging returns of adult fish. Additional emphasis will now be given to building up the coho runs in that portion of the drainage. It is planned to supplement natural production of anadromous salmonids with releases of hatchery stock, the Commission stated.

Although it will take some time to determine the contribution of the East and Middle Forks in helping to maintain and increase the salmon and steelhead runs of the Colombia River, removal of Dee Dam is a big step in the right direction. (Oregon Fish Commission, June 9, 1966.)

Pacific Marine Fisheries Commission

ANNUAL SPRING MEETING FOR 1966 HELD:

The Executive Committee of the Pacific Marine Fisheries Commission (PMFC) held its annual spring meeting in Portland, Oreg., on June 21, 1966.

Alarm at the continuing presence and increasing number of Soviet fishing vessels off Oregon and Washington was expressed by the director of the California Department of Fish and Game. The presence of the Soviet

fleet and its unknown catch destroys the usefulness of PMFC's data series upon which the member PMFC agencies depend for information regarding the abundance of bottomfish. Soviet cooperation in supplying catch statistics and similar biological information and in observing local conservation practices is necessary if the fishery resources are to be managed wisely.

The directors of the Oregon Fish Commission and Washington Department of Fisheries stated that PMFC's announcement on June 9, 1966, of a proposed 7-point policy and program regarding foreign fishing had been helpful to the respective Governor's Committees on Foreign Fishing of which they are members. At a joint meeting of the two committees in June, an 8-point program embracing many of PMFC's provisions was recommended to the Governors of Oregon and Washington. The directors of the Oregon Game Commission and Idaho Department of Fish and Game joined in urging that PMFC's 7-point program be implemented as quickly as possible.

During the discussion of salmon problems, concern was expressed about upsetting the ecology of salmon and steelhead as the result of increased water temperatures resulting from dams and other projects on rivers. The executive director of PMFC was instructed to prepare a proposed resolution urging that high dams on all rivers be designed and operated to provide releases of cold water for the maintenance of salmon and steelhead and other valuable fish. It was urged that studies be expedited of means for accomplishing this at such projects as the Canadian storage dams on the Columbia and High Mountain Sheep Dam on the Snake River. If the cooling potential of those dams is not utilized, the dams will cause increases in water temperatures in addition to those predicted from the Hanford atomic electric plant and those increases already caused by existing dams.

Arrangements were approved for the Pacific Marine Fisheries Commission's annual meeting to be held in Seattle on November 17 and 18, 1966.

Salmon

U. S. PACIFIC COAST
CANNED STOCKS, JUNE 1, 1966:

On June 1, 1966, canners' stocks (sold and unsold) in the United States of Pacific canned salmon totaled 915,886 standard cases (48 1-lb. cans)--125,827 cases less than on May 1, 1966, and 35,758 cases less than on June 1, 1965, when stocks totaled 951,644 standard cases.

On the basis of total stocks of 1,263,744 actual cases (consisting of cans of 1/4-lb., 1/2-lb., 1-lb., etc.), red salmon accounted for 979,602 cases (mostly 1-lb. and 1/2-lb. cans) or 77.5 percent of the total canners' stocks on June 1, 1966; pink salmon accounted for 139,207 cases or only 11.0 percent (68,684 cases were 1-lb. talls and 66,702 cases were 1/2-lb. cans). Next came coho or silver (54,230 cases), followed by king (47,854 cases), and chum salmon (42,851 cases).

Carryover stocks at the canners' level totaled 733,575 standard cases on July 1, 1965, the approximate opening date of the

Table 1 - Total Canners' Stocks of Pacific Canned Salmon, June 1, 1966

Species	June 1, 1966	May 1, 1966	Apr. 1, 1966
	(No. of Actual Cases)		
King	47,854	42,298	58,239
Red	979,602	1,037,435	1,112,151
Coho	54,230	73,153	102,039
Pink	139,207	203,619	255,864
Chum	42,851	68,120	92,726
Total	1,263,744	1,424,625	1,621,019

Table 2 - Canners' Stocks on Hand June 1, 1966 (Sold and Unsold), by Species and Can Size

	King	Red	Coho	Pink	Chum	Total
	(Actual Cases)					
48-1/4 lb.	5,312	111,750	23,634	1,276	26	141,998
48-1/2 lb.	40,814	341,769	20,601	66,702	12,833	482,719
48-1 lb.	1,727	524,256	7,694	68,684	28,423	630,784
12-4 lb.	1	1,827	2,301	2,545	1,569	8,243
Total	47,854	979,602	54,230	139,207	42,851	1,263,744

Table 3 - Canners' Shipments from July 1, 1965, to June 1, 1966, by Species and Can Size

	King	Red	Coho	Pink	Chum	Total
	(Actual Cases)					
48-½ lb.	8,888	313,298	101,204	7,217	41	430,648
48-½ lb.	128,038	641,246	111,947	345,638	81,259	1,308,128
48-1 lb.	19,004	936,367	100,406	980,953	470,120	2,506,850
12-4 lb.	254	7,632	11,968	55,394	15,052	90,300
Total	156,184	1,898,543	325,525	1,389,202	566,472	4,335,926

Pacific salmon packing season. Adding the 1965 new season pack of 3,541,187 standard cases brought the total available supply for the 1965/66 market season to 4,274,762 standard cases.

Shipments at the canners' level of all salmon species from July 1, 1965, to June 1, 1966, totaled 3,358,876 standard cases. The carryover of 733,575 standard cases on July 1, 1965, the beginning of the 1965/66 sales year, was substantially lower (37.6 percent) than the carryover of 1,175,588 cases a year earlier.

Data on canned salmon stocks are based on reports from U. S. Pacific Coast canners who packed over 96 percent of the 1965 salmon pack. (Division of Statistics and Economics, National Canners Association, June 25, 1966.)

Note: See Commercial Fisheries Review, July 1966 p. 43.

* * * * *

FINGERLINGS ARE "BRANDED" IN MIGRATION STUDIES:

About 1/2-million young salmon are being "branded" at the U. S. Department of the Interior's Little White Salmon National Fish Hatchery (near White Salmon, Wash.), announced the Department's Northwest Regional Information Office, May 26, 1966. But the branding is accomplished by a cold method instead of the hot iron technique long used in cattle identification.

The young salmon are held to the branding "iron" for a fraction of a second, imprinting a permanent mark on the skin. It does not harm the fish. The brand merely changes the coloration from light silver to dark gray or black in the area contacted.

The unique branding technique is designed to keep tract of the seaward-bound migrant fish in a comprehensive study of the timing and survival of fingerlings taking place in the Columbia and Snake rivers. The research is conducted by the Seattle office of the Interior Department's Bureau of Commercial Fisheries.

The new method is faster than fin-clipping and increases chances of survival because it does not impair fish mobility. Brands have lasted through the fresh-water life of the fish but it is not known if they will last through lengthy periods in the sea. The mark has lasted up to six months in salt water.

Fingerlings are placed in a tranquilizer and then are held one by one against the branding point, which is a silver U mounted on the end of a 6-inch brass rod. The brass rod extends through the wall of an insulated container filled with dry ice and wood alcohol to create a subfreezing temperature of -68° F. The brass rod conducts the extreme cold to the silver U against which the fingerling is held for branding. Branding takes but an instant and then the fish is placed in a recovery tank.

The U-shaped brand is used as is, inverted, or lying sideways. It is placed on different locations of the fish's body and on either side. A total of 16 different mark combinations are possible from this one U mark.

The 500,000 small salmon that are being branded are fall chinook salmon that were hatched at Spring Creek Hatchery (at Underwood, Wash.) and reared at Big White Salmon Hatchery. The hatchery rearing of the young fish is done by Interior's Bureau of Sport Fisheries and Wildlife.

Branded fish will be released in a turbine and in the tailrace of Ice Harbor Dam on the Snake River and below Priest Rapids and McNary dams on the Columbia River. They will be recaptured at collecting sites at McNary, the Dalles and Bonneville dams, and finally in the estuary at Astoria, Oreg., before the young fish go to the sea.

Scientists are studying the watery environment of the fingerling before additional dams go into operation in the Columbia and Snake rivers. By comparing returns from each release site, biologists should be able to answer such questions as: Can fingerlings adjust to the changing environment of the Columbia River? Can safe fingerling bypasses be developed at "high mortality" areas in the river? How do the large impoundments affect the seaward-bound fish?

The broad scientific study is under the Fish-Passage Research Program of the Bureau of Commercial Fisheries, Seattle, with Howard L. Raymond, fishery research biologist, in charge of the project. He is assisted by other biologists from Washington and from Astoria, Oreg. This is a joint project with the states of Oregon, Washington, and Idaho. The comprehensive fingerling study will continue for several years.

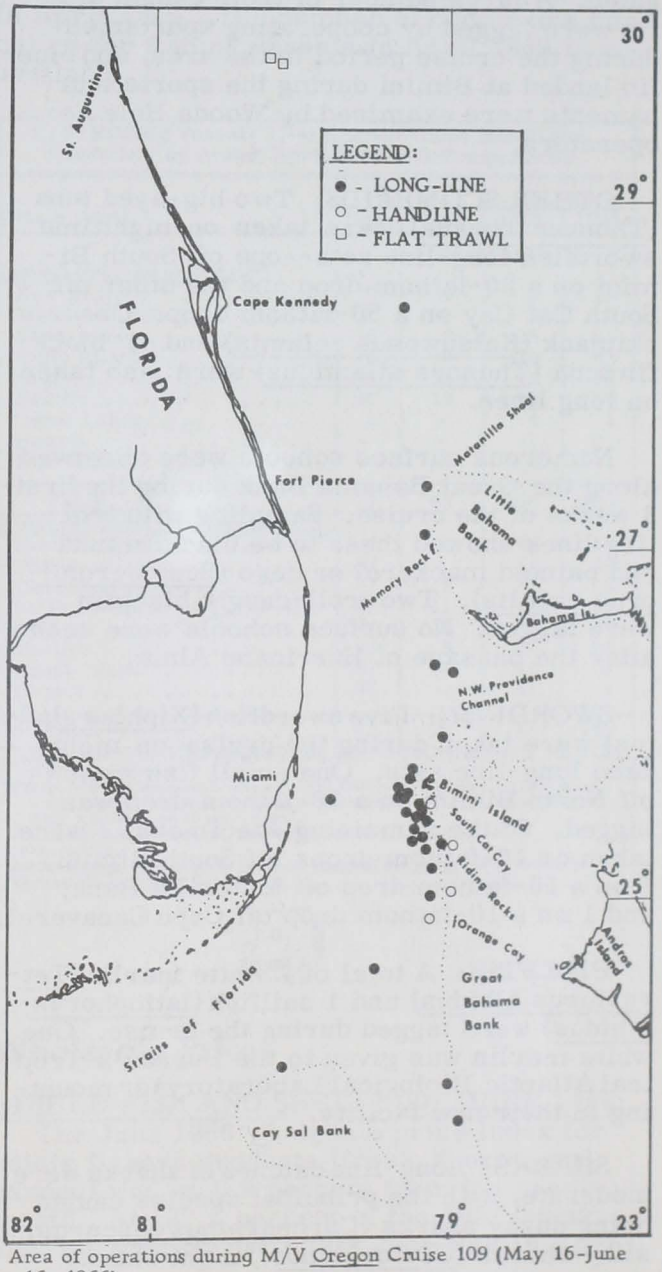
This branding technique has been developed for the most comprehensive and far-reaching study of the fingerling salmon ever undertaken in the Columbia River basin. Information is lacking about the fingerlings' downward journey to the sea. Much more is known about the adult upstream migration to their ancestral spawning grounds, so scientists are researching to fill in the gap on missing knowledge of the fingerlings.

South Atlantic Fisheries Explorations and Gear Development

MIGRATIONS AND SEASONAL DISTRIBUTION OF PELAGIC FISH IN FLORIDA STRAITS STUDIED:

M/V "Oregon" Cruise 109 (May 16-June 16, 1966): A 32-day cooperative study of pelagic fish in the Florida Straits and along the Great Bahama Bank was completed June 16, 1965, by the exploratory fishing vessel Oregon, operated by the Bureau of Commercial Fisheries, U.S. Department of the Interior. Participants in the study included the Bureau's Exploratory Fishing and Gear Research Base, Pascagoula, Miss.; Exploratory Fishing Station, St. Simons Island, Ga.; the Bureau's Tropical Atlantic Biological Laboratory at Miami; Woods Hole Oceanographic Institution; Institute of Marine Science, University of Miami; and the International Game Fish Association. Operations aboard the Oregon were under the joint control of the Bureau and Woods Hole Oceanographic Institute (WHOI).

Objectives of the cruise were to: (1) study the mechanics of bluefin tuna (Thunnus thynnus) migrations along the Great Bahama Bank, (2) gather information on the seasonal distribution and composition of surface tuna schools, and (3) continue observations on the distribution and density patterns of subsurface swordfish populations. Long lines were used for sampling subsurface stocks and trolling lines were used on surface schools.



Area of operations during M/V Oregon Cruise 109 (May 16-June 16, 1966).

BLUEFIN TUNA: A total of 31 sets (total of 8,620 hooks) was made along the Great Bahama Bank and off Cay Sal Bank in the Florida Straits for bluefin tuna. The hooks were baited with mullet, blue runners, and thread herring and were fished on drops varying from surface to 50 fathoms. Only one bluefin (a 350-pound specimen) was taken which was caught off Brown Cay on a 20-fathom drop. Considering the effort expended with long lines and the negative results, there appears to be a strong indication that migrating bluefin are not available to long-line gear at that time within the region investigated. A large number of troll-caught bluefin were tagged by cooperating sportsmen during the cruise period in the area, and bluefin landed at Bimini during the sports tournaments were examined by Woods Hole cooperators.

OTHER SCOMBRIDS: Two big-eyed tuna (Thunnus obesus) were taken on nighttime swordfish long-line sets--one off South Bimini on a 20-fathom drop and the other off South Cat Cay on a 50-fathom drop. One skipjack (Katsuwonus pelamis) and 4 blackfin tuna (Thunnus atlanticus) were also taken on long lines.

Numerous surface schools were observed along the Great Bahama Bank during the first 3 weeks of the cruise. Sampling with trolling lines showed these to be blackfin tuna and painted mackerel or cero (Scomberomorus ragalis). Two troll-caught blackfin were tagged. No surface schools were seen after the passage of Hurricane Alma.

SWORDFISH: Five swordfish (Xiphias gladius) were taken during the cruise on nighttime long-line sets. One small fish caught off North Bimini on a 20-fathom drop was tagged. Of the remaining specimens, 2 were taken on 10-fathom drops off South Bimini, 1 on a 10-fathom drop off Matanilla Bank, and 1 on a 10-fathom drop off Cape Canaveral.

BILLFISH: A total of 7 white marlin (Tetrapterus albidus) and 1 sailfish (Istiophorus albidus) were tagged during the cruise. One white marlin was given to the Bureau's Tropical Atlantic Biological Laboratory for mounting in their new facility.

SHARKS: Long-line catches of sharks were moderate, with the principal species caught being dusky sharks (Carcharhinus obscurus), silky sharks (C. floridanus), night sharks (Hypoprion signatus), hammerhead sharks (Sphyrna mokarran), and mako sharks (Isurus oxyrinchus). About 500 pounds of shark meat and liver, representing 50-pound samples from each species and sex, were collected for the Bureau's Technological Laboratory at Seattle, Wash.

A 300-pound sample of dolphin (Coryphaena hippurus) was caught for test marketing by industry. Samples of hake (Merluccius albidus) were taken by trawl on the royal-red shrimp grounds off St. Augustine, Fla., for the Bureau's Biological Laboratory, La Jolla, Calif.

OCEANOGRAPHIC COLLECTIONS: Bathythermograph and Nansen bottle casts were made by WHOI participants at each long-line station for determination of temperature structure, dissolved oxygen, salinity, nitrate, and nitrite concentrations. Vertical and horizontal plankton tows were made for investigation of zooplankton structures and chlorophyll levels.

U. S. Fishing Vessels

FISHERIES LOAN FUND
AND OTHER FINANCIAL AID
FOR VESSELS, APRIL 1-JUNE 30, 1966:

From the beginning of the program in 1956 through June 30, 1966, a total of 1,830 applications for $46,458,719 was received by the U. S. Bureau of Commercial Fisheries, the agency administering the Federal Fisheries Loan Fund. By that date, 957 applications ($21,119,566) had been approved, 581 ($13,414,413) had been declined or found ineligible, 260 ($9,141,502) had been withdrawn by the applicants before being processed, and 32 ($697,608) were pending. Of the applications approved, 347 were approved for amounts less than applied for--the total reduction was $2,085,630.

The following loans were approved from April 1, 1966, through June 30, 1966:

New England Area: Earl L. Brewer, Boothbay, Me., $7,100; Arthur Reposa, Narrangansett, R. I., $17,000; Arthur Reposa, Narragansett, R. I., $35,000; James J. Mello, Wakefield, R. I., $58,000.

South Atlantic and Gulf Area: John Joseph Ross, Moss Point, Miss., $29,332.

California Area: Veryl W. Dawson, Aro-as, $4,973; Chester L. Russell, Napa, ,240; Charles W. Beyers, Santa Cruz, ,760; Frank Brenha, Jr., San Diego, 40,000; Curtt M. Olsen, San Diego, $17,872.

Pacific Northwest Area: Howard Vining, ookings, Oreg., $21,000; and the following m Washington State: James P. Allenbaugh, erdeen, $22,000; George A. Bold, Aber-en, $71,250; Jack M. Torgerson, Aberdeen, ,000; John C. Edwards, Hoquiam, $30,000; nes D. Barclay, Marysville, $12,000; Ron-D. Watson, Marysville, $9,380; Tage B. smussen, Tacoma, $3,276; Iceland Boat , Seattle, $89,000; Parks Canning Co., Inc., ttle, $75,000.

Alaska Area: Charles L. Johnson, Anchor int, $15,000; Truman C. Emberg, Dilling-m, $6,345; Glenn J. Couch, Homer, $6,662; chard T. Hinde and Ole G. Harder, Kodiak, 09,000; Jake M. Hallingstad, Petersburg, ,500; Samuel Martin, Seldovia, $16,000; Roy Hollman, Seward, $4,800.

Under the Fishing Vessel Mortgage Insur-e Program (also administered by the Bu-au) during the second quarter of 1966, a al of 13 applications for $656,000 was re-ived. Since the program began (July 5, 0), 122 applications were received for ,378,245. Of the total, 93 applications e approved for $6,721,656 and 16 applica-s for $1,785,600 were pending as of June 1966. Since the mortgage insurance pro-m began, applications received and ap-ved by area are:

New England Area: Received 15 ,796,750), approved 11 ($1,367,178).

California Area: Received 2 ($1,262,000), roved 2 ($1,262,000).

South Atlantic and Gulf Area: Received ($4,816,524), approved 66 ($3,092,169).

Pacific Northwest Area: Received 13 ,127,375), approved 8 ($635,535).

Alaska Area: Received 7 ($375,596), ap-ved 6 (364,774).

The first applications for a Fishing Ves-Construction Differential Subsidy under Bureau's expanded program were re-ved in December 1964. Through June 30, 6, a total of 69 applications for an esti-mated $16,867,000 in subsidies had been received. Public hearings on 48 applications were held--40 applications for estimated subsidies totaling $8,278,500 were approved and 8 subsidy contracts in the amount of $1,214,558 were executed.

Note: See Commercial Fisheries Review, June 1966 p. 36.

* * * * *

DOCUMENTATIONS ISSUED AND CANCELLED, APRIL 1966:

During April 1966, a total of 75 vessels of 5 net tons and over was issued first documents as fishing craft as compared with 63 in April 1965. The number of documents cancelled for fishing vessels in April 1966 is not available.

U. S. Fishing Vessels 1/--Documentations Issued and Cancelled, by Areas, April 1966 with Comparisons

Area (Home Port)	April		Jan.-Apr.	
	1966	1965	1966	1965
	(Number)			
Issued first documents 2/:				
New England	6	4	9	11
Middle Atlantic	2	-	3	3
Chesapeake	5	3	25	11
South Atlantic	8	7	19	23
Gulf	19	35	79	84
Pacific	33	13	68	46
Great Lakes	2	-	4	1
Hawaii	-	-	1	-
Puerto Rico	-	1	-	1
Total	75	63	208	180
Removed from documentation 3/:				
New England	4/	6	4/	15
Middle Atlantic	4/	-	4/	10
Chesapeake	4/	2	4/	8
South Atlantic	4/	11	4/	32
Gulf	4/	8	4/	37
Pacific	4/	8	4/	29
Great Lakes	4/	1	4/	8
Hawaii	4/	-	4/	1
Total	4/	36	4/	140

1/Includes both commercial and sport fishing craft. A vessel is defined as a craft of 5 net tons and over.
2/There were 2 redocumented vessels in April 1966 previously removed from the records. Vessels issued dirst documents as fishing craft were built: 51 in 1966; 4 in 1965; 1 in 1962; and 19 prior to 1957.
3/Includes vessels reported lost, abandoned, forfeited, sold alien, etc.
4/Not available.
Source: Monthly Supplement of Merchant Vessels of the United States, Bureau of Customs, U.S. Treasury Department.

Wholesale Prices

EDIBLE FISH AND SHELLFISH, JUNE 1966:

The June 1966 wholesale price index for edible fishery products (fresh, frozen, and canned) was up 0.2 percent from the previous month. At 127.2 percent of the 1957-59 average, the overall index this June was 16.9 per-

cent higher than the same month a year earlier. Prices this June, with few exceptions, were sharply higher than in the same month of 1965.

Lower prices in June 1966 for ex-vessel large haddock at Boston (down 6.6 percent), Lake Superior fresh whitefish at Chicago (down 23.6 percent), and Great Lakes round yellow pike at New York City (down 18.6 percent) were offset by higher prices at New York City for western fresh king salmon (up 8.6 percent) as compared with prices for frozen salmon marketed the previous month. June prices were up slightly for western fresh and frozen halibut (up 1.6 percent). As a result, the subgroup index for drawn, dressed, or whole finfish was up 1.3 percent from May to June. As compared with June 1965, the subgroup index this June was higher by 7.2 percent--prices were up from a year earlier for all items except whitefish (down 13.1 percent). Prices for western halibut were 10.3 percent higher than in June 1965; by 8.2 percent for salmon; and by 7.5 percent for large haddock.

Prices at New York City for South Atlantic fresh shrimp were lower by 4.2 percent from May to June because of increased market supplies. Although June prices were higher at Boston for fresh haddock fillets (up 9.3 percent), the subgroup index for processed fresh fish and shellfish was down 1.8 percent from the previous month due solely to the lower prices for shrimp. Prices remained unchanged for standard shucked oysters. As compared with June 1965, the subgroup index this June was up 20.8 percent because of substantially higher prices for all items. June 1966 fresh shrimp prices were up 29.1 percent from the same month a year earlier, small haddock fillets (up 15.5 percent), and oysters (up 12.2 percent).

The June 1966 subgroup index for processed frozen fish and shellfish rose 1.4 percent from the previous month. June prices were higher at Chicago for frozen shrimp (up 1.8 percent) and at Boston for frozen haddock fillets (up 1.2 percent); for other items in the subgroup there was no change. The subgroup index this June was 17.7 percent higher than in the same

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

Group, Subgroup, and Item Specification	Point of Pricing	Unit	Avg. Prices 1/ ($)		Indexes (1957-59=100)			
			June 1966	May 1966	June 1966	May 1966	Apr. 1966	June 1965
ALL FISH & SHELLFISH (Fresh, Frozen, & Canned)					127.2	126.9	126.5	108.9
Fresh & Frozen Fishery Products:					128.3	127.8	125.0	111.5
Drawn, Dressed, or Whole Finfish:					121.5	119.9	116.6	113.3
Haddock, lge., offshore, drawn, fresh	Boston	lb.	.12	.13	94.8	101.5	92.0	88.2
Halibut, West., 20/80 lbs., drsd., fresh or froz.	New York	lb.	.48	.48	142.7	140.5	140.5	129.4
Salmon, king, lge. & med., drsd., fresh or froz.	New York	lb.	.94	.87	131.3	120.9	120.5	121.4
Whitefish, L. Superior, drawn, fresh	Chicago	lb.	.54	.70	79.8	104.4	78.3	91.8
Yellow pie, L. Michigan & Huron, rnd., fresh.	New York	lb.	.61	.75	99.9	122.8	139.1	90.1
Processed, Fresh (Fish & Shellfish):					132.4	134.8	130.1	109.6
Fillets, haddock, sml., skins on, 20-lb. tins	Boston	lb.	.41	.38	99.6	91.1	97.2	86.2
Shrimp, lge. (26-30 count), headless, fresh	New York	lb.	1.15	1.20	134.7	140.6	128.9	104.3
Oysters, shucked, standards	Norfolk	gal.	8.00	8.00	134.9	134.9	137.0	120.2
Processed, Frozen (Fish & Shellfish):					125.5	123.8	123.0	106.6
Fillets: Flounder, skinless, 1-lb. pkg.	Boston	lb.	.43	.43	109.0	109.0	109.0	98.8
Haddock, sml., skins on, 1-lb. pkg.	Boston	lb.	.39	.39	114.3	112.9	112.9	108.5
Ocean perch, lge., skins on 1-lb. pkg.	Boston	lb.	.33	.33	114.0	114.0	112.2	105.2
Shrimp, lge. (26-30 count), brown, 5-lb. pkg.	Chicago	lb.	1.12	1.10	132.8	130.4	129.2	105.5
Canned Fishery Products:					125.6	125.6	129.6	104.9
Salmon, pink, No. 1 tall (16 oz.), 48 cans/cs.	Seattle	cs.	28.50	28.50	124.2	124.2	124.2	95.9
Tuna, lt. meat, chunk, No. 1/2 tuna (6-1/2 oz.), 48 cans/cs.	Los Angeles	cs.	13.69	13.69	121.5	121.5	131.8	102.6
Mackerel, jack, Calif., No.1 tall (15 oz.), 48 cans/cs.	Los Angeles	cs.	8.00	8.00	135.6	135.6	129.3	120.9
Sardines, Maine, keyless oil, 1/4 drawn (3-3/4 oz.), 100 cans/cs.	New York	cs.	10.25	10.25	131.5	131.5	131.5	131.5

1/Represent average prices for one day (Monday or Tuesday) during the week in which the 15th of the month occurs. These prices are published as indicators of movement and not necessarily absolute level. Daily Market News Service "Fishery Products Reports" should be referred to for actual prices.

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

nth in 1965. Prices were generally higher r all items in the subgroup--substantially gher for frozen shrimp (up 25.9 percent) d flounder fillets (up 10.3 percent).

Prices for all canned hery products were unanged from May to June 66. Market conditions re steady to firm and cks of several products, particularly canned salmon, were low. But compared with the same month a year earlier, the index this June was up 19.7 percent. Prices were higher than in June 1965 for canned pink salmon (up 29.5 percent), canned tuna (up 18.4 percent), and California jack mackerel (up 12.2 percent). Prices for canned Maine sardines remained unchanged for each of the months indicated. (U. S. Department of the Interior, Bureau of Commercial Fisheries, Fishery Market News Service.)

BEAR PREDATION ON SALMON UNDER STUDY IN ALASKA

An electric fence is in place to keep Alaskan brown bears out of part of Grassy Point Creek, a tributary of Karluk Lake 80 miles west of Kodiak, Alaska. The electric fence was put up to help biologists find out how extensively bears prey on the salmon in the stream. The project was described in September 1965 by the scientist in charge of the Karluk Lake Field Station of the U. S. Bureau of Commercial Fisheries.

Salmon population in the controlled section of the bearless stream will be compared to the number of fish in the stream where bears may freely wander. The effect on salmon populations and egg deposition will be considered. It's part of comprehensive studies to consider all the factors in a salmon's environment and survival.

When a bear takes an unspawned female sockeye (red) salmon for his dinner he is also destroying from 3,000 to 5,000 eggs. With a high bear population the number of eggs destroyed by the huge animals is sizable.

Some surprising problems have come up in the study. For one thing "bruin" isn't cooperating completely. He likes salmon too well. He's willing to endure a strong, painful electric shock to break the wires and get into the salmon stream. As a result, scientists are constantly repairing the electric fence.

The bear predation study was started in 1964. In areas where bears are allowed to prey on salmon, the remains of dead salmon gather and scientists determine the spawned to unspawned ratio. In 1964, only 15 percent of the bear-killed female salmon were unspawned. Most of the fish taken by the "brownies" had already spawned. In the summer of 1965, bear predation on salmon appeared to be at a minimum. Biologists pump salmon eggs from the stream to learn the number of eggs deposited in areas with bear predation and the numbers without.

The study may show that the total effect of the bears on the salmon resource is minor, but this remains to be determined.

TOP HONORS GO TO INTERIOR DEPARTMENT FISHERY RECIPE BOOKLET

The fishery recipe booklet Fish and Shellfish Over the Coals, issued by the U. S. Department of the Interior's Bureau of Commercial Fisheries, was one of three of that Department's publications awarded top honors as outstanding publications of their kind in the 1966 Federal Editors Association's Publications contest. The awards were made in Washington, D. C., on June 21, 1966, by Vice President Hubert H. Humphrey and John W. Macy, Jr., chairman of the Civil Service Commission.

Fig. 1 - Vice President Humphrey comments enthusiastically on Fish and Shellfish Over the Coals.

Fig. 2 - John W. Macy, Jr. presents the Blue Pencil Highest Achievement Award to Charles Butler, the Bureau's Assistant Director for Industrial Research.

The Bureau's fishery recipe booklet received the award as the best full-color publication. The other honors to Interior publications were for The Natural Resources of Utah, as the best popular publication in a series, and Aquatic Pests on Irrigation Systems, as the best technical publication.

Fish and Shellfish Over the Coals was acclaimed the outstanding United States Government publication released in 1965 in the full color category. The Bureau's Branch of Marketing which created the booklet, was awarded the Blue Pencil Highest Achievement Award. Vice President Humphrey made many favorable comments regarding the booklet. He said, "I want to tell you that I just wanted to go right out on the seashore after reading it. It is really great."

Fish and Shellfish Over the Coals is a 24-page illustrated recipe booklet, one of a series presenting appealing and appetizing ways of preparing fish and shellfish. It is an epicurean's delight, and there is no doubt about that. It can be purchased for 40 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

All three publications that were honored were judged on the basis of appearance, organization, presentation of material, readability, suitability to purpose, and thoughtful use of space, paper, and type.