

TRENDS AND DEVELOPMENTS

A METHOD OF FORECASTING THE RELATIVE ABUNDANCE OF NORTHERN SHRIMP (*Pandalus borealis* Kr.) IN MAINE WATERS

By R. L. Dow*

Northern shrimp (*Pandalus borealis* Kr.) concentrated on spawning grounds of Maine in-shore waters have been fished commercially each year since the 1937/1938 spawning season. Spawning activity reaches a peak during February and March, although commercially attractive schools have been found in some years as early as October and as late as June.

Table 1 - December Sea Water Temperatures and Shrimp Landings Two Years Later

Spawning Year	Temperatures °F.	Shrimp Landings	Catch Year
		1,000 Lbs.	
1953/54	48.4	0	1955/56
1954/55	46.6	0	1956/57
1951/52	46.2	0	1953/54
1950/51	45.9	38	1952/53
1956/57	44.8	11	1958/59
1949/50	44.3	104	1951/52
1952/53	43.7	0	1954/55
1957/58	42.8	90	1959/60
1948/49	42.5	45	1950/51
1960/61	42.1	529	1962/63
1959/60	41.9	340	1961/62
1937/38	41.7	8	1939/40
1962/63	41.5	2,068	1964/65
1946/47	41.3	10	1948/49
1961/62	41.2	898	1963/64
1958/59	41.0	64	1960/61
1955/56	40.8	5	1957/58
1943/44	40.1	162	1945/46
1947/48	40.0	7	1949/50
1940/41	39.7	292	1942/43
1941/42	39.5	389	1943/44
1944/45	39.2	194	1946/47
1935/36	37.9	83	1937/38
1942/43	37.4	554	1944/45
1938/39	37.3	54	1940/41
1936/37	36.0	18	1938/39
1939/40	33.7	79	1941/42
1945/46	31.1	27	1947/48



Fig. 1 - Northern shrimp (*Pandalus borealis* Kr.)--the smaller sizes are discarded.

Shrimp abundance has been associated with sea water temperatures during the period of spawning two years preceding their entry into the fishery (Dow 1963). This association includes all months from October through July. Typical of the association is the record shown in table 1 of December sea water temperatures as measured at Boothbay Harbor by the U. S. Fish and Wildlife Service and landings of shrimp during the fishing season two years later.

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Table 2 - Temperature Ranges by Months and Shrimp Landings Two Years Later

Month	Temp. Range OF.	Shrimp Landings	Catch Year
		1,000 Lbs.	
October	53.2-57.6	0	1953/54 & 1954/55
November	49.7-51.3	0	1955/56 & 1956/57
December	42.5-48.4	5	1957/58
January	39.6-43.0	7	1949/50
February	37.0-41.9	10	1948/49
March	39.4-43.0	11	1958/59
April	44.4-45.5	38	1952/53
May	50.4-52.2	45	1950/51
June	56.5-57.9	90	1959/60
July	61.5-63.4	104	1951/52
October	49.2-52.8		
November	44.8-48.6	340	1961/62
December	37.4-42.1	529	1962/63
January	32.8-39.0	2,068	1964/65
February	32.0-36.3	898	1963/64
March	33.6-38.3	292	1942/43
April	37.0-43.5	162	1945/46
May	46.0-50.0	194	1946/47
June	52.9-56.3	389	1943/44
July	55.5-60.8	554	1944/45
October	48.0-		
November	43.8-39.3	83	1937/38
December	37.3-31.1	79	1941/42
January	31.4-	64	1960/61
February	31.7-29.1	54	1940/41
March	32.3-30.0	27	1947/48
April	36.2-34.6	18	1938/39
May	44.4-43.8	8	1939/40
June	52.7-49.8		
July	-		

Within the October-July period, various temperature ranges are associated with varying levels of shrimp abundance and availability two years later, as indicated by landings of this intensive winter fishery. Monthly temperature ranges of the period and shrimp landings within the ranges are summarized in table 2. In general, the greatest abundance is associated with the upper half of the optimum temperature range, while the least abundance is associated with the highest temperature and the greatest fluctuations in temperature. Intermediate levels of abundance are associated with low and intermediately high temperatures.



Fig. 2 - Unloading northern shrimp at a Maine processing plant.



Fig. 3 - Hand peeling and processing of northern shrimp.



Fig. 4 - Northern shrimp come off peeling machine in a Maine processing plant.

The consistent association of medium-range sea water temperatures with the years of greatest shrimp abundance, of high ranges and unusual fluctuations with zero to low abundance, and of low or intermediately high ranges

with intermediate abundance, suggests that sea water temperature measurements made at Boothbay Harbor during the spawning year can be used to predict the relative abundance of commercial-size shrimp during the fishing season two years later.

REFERENCE

DOW, ROBERT L.

1963. "Fluctuations in Maine Shrimp Landings," Commercial Fisheries Review, vol. 25, No. 4 (April). (Also Sep. No. 673.)

Fishing Vessel and Gear Developments

EQUIPMENT NOTE NO. 19--

TRAWL COD-END CLOSING DEVICE:

Recently, several new types of cod-end closing devices, "Holland Clip," "Nautilus Clip," and a two-armed clip (produced by the firm Maskinfabrik Iras in Denmark) have made their appearance (Fishing News International 1965). The "Holland Clip" is being used by British bottom, herring, and sprat trawlers (Fishing News International 1964). During 1965, the "Holland Clip" was tested successfully aboard two U. S. Bureau of Commercial Fisheries chartered trawlers, the Western Flyer and St. Michael.

Most Pacific northwest trawl fishermen now use a puckering string tied closed by a hangman's knot. This knot rarely comes untied while fishing, yet it does have two disadvantages: (1) The larger the catch, the more difficult the knot is to release; sometimes three men are required to pull open the knot. (2) Time is lost when splitting large catches aboard the vessel since the knot must be retied after each split is dumped.

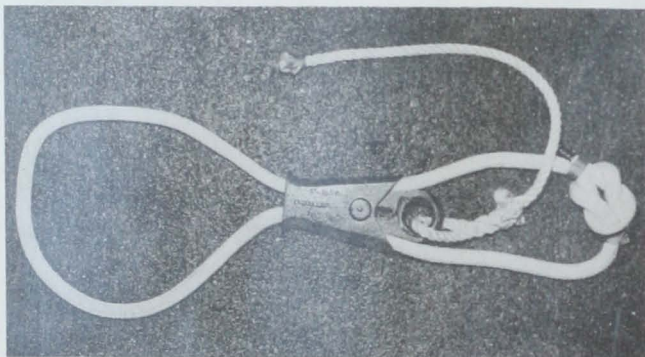


Fig. 1 - Sample "Clip" and puckering string arrangement. Wedge has been pushed into place within the sleeve, leaving only the eye exposed. A piece of rope is tied to the wedge eye for ease of releasing. Note the loose ends of puckering string are tied to prevent "Clip" from being lost if the wedge should loosen.

The "Holland Clip" is composed of a tapered steel sleeve and a grooved wedge fitted within (fig. 1). When the eyed wedge is driv-

en into the sleeve, it binds against a braided nylon puckering string. To release the "Clip," the wedge is pulled out of the sleeve. A short rope tied to the wedge eye facilitates pulling the wedge. The puckering string ends are tied together and seized to prevent them from coming free of the "Clip."

Twist rope was used with the "Clip" aboard the trawler St. Michael. On several occasions after the wedge was released, the rope caught between the wedge corner and the sleeve. This caused the rope to untwist and not pull freely through the sleeve.



Fig. 2 - Underwater view of "Holland Clip" and closed cod end containing 15,000 pounds of hake. The loosely tied hangman's knot prevents the wedge from releasing accidentally while the net is being set.

On two occasions aboard the trawler Western Flyer, the wedge fell free when no strain was placed on the puckering string as the net was set. This difficulty was eliminated by tying either a loose slip knot or hangman's knot in the free end of the puckering string (fig. 2). This knot was removed easily when the first split came onboard since no strain

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was placed on it regardless of the catch size. The "Clip" was used without a knot during all subsequent splits of the tow.

Catches of up to 60,000 pounds were made during 170 experimental tows by the trawler Western Flyer. As many as 40 splits were required to bring large catches aboard. Hake were dumped into the hold at a rate of about 1,000 pounds a minute during splitting with the "Holland Clip." Comparing this device with the usual method of tying the puckering string when splitting, it is believed that a time saving of over 30 percent per split was made. Almost three splits could be made using the "Holland Clip" in the same time required to make two splits using the hangman's knot. Time saved amounted to nearly two days during the experimental fishing period.

LITERATURE CITED

FISHING NEWS INTERNATIONAL

1964. Cod-End Clip. Fishing News International, vol. 3, no. 4, p. 351.

1965. Cod-End Clips. Fishing News International, vol. 4, no. 3, pp. 350, 353.

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Alaska

FOREIGN FISHING ACTIVITY OFF ALASKA, DECEMBER 1965:

U.S.S.R.: At year's end about 85 Soviet vessels were involved in ocean perch trawling in the Gulf of Alaska as compared with 15 vessels at the end of 1964. The eastern Gulf continued to be the area of greatest Soviet activity with nearly 70 vessels divided into two nearly equal fleets. One fleet remained fishing the grounds generally west of Yakutat Bay throughout December, after the second split away late in the month and moved again to the area west of Cape Ommaney off Southeast Alaska.

About mid-December, the Soviets reported that bad weather in the Aleutian Islands area prompted shifting of their trawling efforts to the Chirikof Island region southwest of Kodiak Island. By month's end at least 15 trawlers, mostly BMRT factory trawlers, were believed to be fishing between Chirikof and the Shumagin Islands.

Soviet trawling in the central and western Aleutians dropped off to about five BMRT factory trawlers following the transfer of other such vessels to the Gulf of Alaska.

During December, 2 more SRT-M trawlers joined the Soviet shrimp fleet in the Gulf of Alaska, making a total of at least 10 such vessels in that fishery. A group of about 5 of those trawlers was operating east of the Trinity Islands off southwest Kodiak Island. The remaining 5 vessels were working near the Shumagin Islands.

The Soviets indicated vessels were being dispatched to the 1965/66 herring expedition in the central Bering Sea. In past years more than 150 Soviet vessels engaged in that fishery, which is centered generally northwest of the Pribilof Islands.

Japan: Japanese trawling efforts in the Gulf of Alaska involved 4 factory trawlers by the end of December after 2 of the vessels had briefly returned to Japan. One trawler fished south of Unalaska Island just west of Unimak Pass and the others continued to concentrate on the Albatross Bank region off southwest Kodiak Island. Early in 1966, two additional trawlers were scheduled to join the Japanese Gulf fleet.

One factory trawler and a side trawler fished throughout the month in the western Aleutians. A second factory trawler which had been fishing in the area returned to Japan for repairs, but was scheduled to rejoin that fishery in early January.

A factoryship accompanied by 6 trawlers left Japan early in December for the eastern Bering Sea. By mid-month the fleet was fishing just north of Unalaska Island. That fleet was believed to be primarily seeking Pacific ocean perch and possibly Alaska pollock.

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SITKA TO HAVE NEW HARBOR:

Sitka will have a new harbor for its growing fishing fleet in 1966. The job is being done under a \$1,076,000 U. S. Army Corps of Engineers contract. Work began in July 1964 and was scheduled for completion by January 1, 1966. The new harbor will have an area of 16 acres and provide space for 450 fishing craft.

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KODIAK KING CRAB FISHERY:

King crab fishermen in Kodiak found it increasingly difficult during December to unload their crab catches at Kodiak canneries. Some vessels experienced nearly delays of two weeks between catch and delivery. Cannery operators attributed the problem to a combination of factors. The current season had the advantage of fine weather and catches were exceptional. However, Kodiak lacks sufficient electrical power to operate all of the canneries at full capacity. Compounding the problem further was the shortage of cannery workers.

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VESSEL TAXATION CHANGE PROPOSED:

The League of Alaska Cities recommended to Senator Hansen that the vessel tonnage taxation law be repealed. The law allows for taxing vessels by tonnage, with a maximum tax of \$15. It would be replaced by a value proportion assessment on the vessel's fair market value. The law could mean a tax increase of \$50 to \$1,000 a year for each resident Alaskan boat owner. Those hardest hit by the proposed tax would be vessel owners who are replacing gear lost in the earthquake.



Alaska Fishery Investigations

FOOD HABITS AND BEHAVIOR OF SALMON FRY:

Over 200 stomachs of pink and chum salmon fry collected in 1965 were examined as part of a U. S. Bureau of Commercial Fisheries investigation of food habits, food availability, and behavior of fry at Traitors Cove. Some of the most important food items are: copepods, barnacle nauplii, barnacle cyprids, and cladocerans. An intertidal species of the insect order Collembala and dipterans, mostly chironomids, were important in some collections. In May 1965, fry were confined in a one-meter plankton net at Traitors Cove to study digestion rates. Stomachs of fish thus deprived of food were emptied in about six hours. The average number of food organisms found in "full stomachs" was about 60 indicating that on the average each fish consumed about 240 organisms a day. Zooplankton densities in June 1965 amounted to 40 organisms per liter in the outer bay. Therefore, only 6 liters of water contained a one-day supply of food for one fish. This relationship between food abundance and demand suggests that zooplankton density was not an

important factor in determining movement, distribution, and survival of fry at that time. A fry and plankton sampling program will be designed for the 1966 field season to further explore relationships between food availability and salmon fry.

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RED SALMON FRESH-WATER SURVIVAL RATES LOW IN KARLUK:

Analyses of red salmon egg-to-smolt survival data for the Naknek and Karluk systems show that for the 4 brood years 1958 through 1961, average survival rate for Karluk was about 0.31 percent while for the same period in the Naknek system, the survival rate from egg to smolt was about 0.75 percent. The average potential egg deposition for Karluk was 561 million and for Naknek 1,504 million eggs. The lower survival rate in the Karluk system is of particular interest because the lake appears to be much higher in basic productivity than the Naknek lakes. Studies to explain this phenomena and to relate it to optimum red salmon production are continuing.



Alaska Fisheries Explorations and Gear Development

SHRIMP RESOURCES AND GEAR EFFICIENCY STUDIED:

M/V "John R. Manning" Cruise 65-3 (October 4-December 9, 1965): Gear research on shrimp pot efficiency and design was conducted during a 9-week cruise by the U. S. Bureau of Commercial Fisheries exploratory fishing vessel John R. Manning. Objectives were to: (1) test fish effectiveness of 7 types of shrimp pots, (2) locate commercial quantities of shrimp, and (3) obtain data on distribution and abundance of spot shrimp (Pandalus platyceros).

The 7 experimental shrimp pots were fished by the long-line method. Six of the pots were constructed with metal frames covered with 1½"-nylon web. Included were a cubical 6-tunnel pot, a rectangular 2-tunnel pot, a cubical galvanized 4-tunnel pot, 2 triangular pots, and a collapsible circular pot. The 7th type was a rectangular pot constructed of wooden slats with web tunnels at each end.



Shows areas of operation during M/V John R. Manning Cruise 65-3 (October 4-December 9, 1965).

Each long line consisted of a large surface buoy, a buoy line, anchor, and a 40-fathom groundline. One of each type pot was attached to the groundline by 1-fathom dropper lines at 5-fathom intervals. The position of the pots on the groundline was randomly predetermined for each string. Alternate strings were furnished with a recording thermometer.

Echo-soundings were made at each station to determine if the bottom was trawlable. A standard 40-foot Gulf of Mexico shrimp trawl made 13 drags. Twelve pounds of spot shrimp were taken in 3 drags made in Eliza Harbor.

A total of 350 strings of pots was set in the inside waters and bays along Stephens Passage, the north and west sides of Kuiu Island and the southeastern side of Baranof Island (chart). A total of 147 pounds of spot shrimp was taken averaging 22 count (heads on). This was primarily a gear research cruise, concentrated in areas where industry reported locations of spot shrimp. More stations were made in the Keku Strait and Tebenkof Bay areas of Kuiu Island, where 90 per-

cent of the total catch of spot shrimp was taken.

Preliminary analysis of the data indicates the wooden pots were more efficient than the other six pot types. Future work is being planned to obtain more data needed to substantiate the results.

Note: See Commercial Fisheries Review, Dec. 1965 p. 25.



California

FALL 1965 PELAGIC FISH POPULATION SURVEY:

M/V "Alaska" Cruise 65-A-9-Pelagic Fish (October 14-November 3, 1965): The inshore waters, offshore islands, and banks of southern California between Coal Oil Point and the U. S.-Mexican border were explored during this cruise by the California Department of Fish and Game research vessel Alaska.

The objectives were to: (1) determine the distribution and abundance of northern anchovies (Engraulis mordax), jack mackerel (Trachurus symmetricus), Pacific mackerel (Scomber diego), and Pacific sardines (Sardinops caeruleus); (2) make two deep tows to obtain reference collections of bathypelagic species for the proposed Food Habits Study to be conducted under the Bartlett Bill; (3) conduct several daylight fathometer runs to obtain information on fish school distribution using the Westrex Precision Depth Recorder (PDR), model Mark XV; and (4) continue the evaluation of the 30-foot midwater trawl as a sampling tool.

The midwater trawl, blanketnet, and echosounder were the tools used. The larger trawl net (50-foot mouth opening) was used for deep tows and the smaller (30-foot) was used for shallower tows. Eighty-six percent of all tows were shallow, i.e. the bottom of the net was less than 70 feet below the surface. A total of 42 trawl and 44 night-light/blanketnet stations were occupied.

Daylight echo-sounding runs were made on four occasions to locate and count fish schools. No species identification was made of the schools. The largest number of schools was found off the Los Angeles-Long Beach Harbor in water less than 50 fathoms deep.

NORTHERN ANCHOVY: Anchovies were captured in 62 percent of all tows made. In-shore waters, within 5 miles of the mainland, were most productive with 90 percent of the tows successful. Only 36 percent of the tows made in offshore waters and near the offshore islands were successful. The largest fish were caught in the Port Hueneme and offshore areas. Nearly all the anchovies caught in those areas were large adults; gravid females were captured in two offshore tows. Large numbers of pinhead anchovies were found in the Santa Monica Bay area and near La Jolla.

The night-light was not as effective as the trawl in obtaining anchovy samples. Of 44 stations made, anchovies were attracted at 16, or 36 percent, and samples were collected at 3.

The night-light was surprisingly successful in attracting pinhead anchovies in the clear, blue oceanic waters off the coast between Dana Point and La Jolla. Anchovies caught at light stations averaged 129 fish a pound in Santa Monica Bay and 40 fish a pound off Port Hueneme, about the same as those caught by the trawl in these areas.

PACIFIC AND JACK MACKEREL: One Pacific mackerel was caught by hook and line at a light station near San Clemente Island. Jack mackerel were caught at nine stations, eight trawl and one light. The largest catch was 50 jacks caught with the trawl near San Clemente Island. Jacks were 11 to 154 quarter centimeters (4.3-15.2 inches) long.

PACIFIC SARDINE: No sardines were seen or captured during this cruise.

MISCELLANEOUS: Two tows at depths over 200 fathoms were made to obtain reference material of bathypelagic species for the proposed Food Habits Study. About 5,600 fish of 28 species were taken. Pacific hake (*Merluccius productus*) were caught in one of the tows in the Santa Barbara channel.

Two sets of tows in identical areas and depths were made to compare the effectiveness of the two different-sized trawl nets. Because of the time involved in changing nets and bridles the two nets could not be used the same night. The catch of anchovies was essentially the same for each net.

Sixty miles were scouted at night for fish schools, but due to poor bioluminescence in

the water only 1 anchovy and 3 mackerel schools were sighted. Only one day was lost because of poor weather.

M/V "Alaska" Cruise 65-A-10-Pelagic Fish (November 12-December 2, 1965): The coastal waters of central California from Point Reyes to Coal Oil Point were surveyed. Objectives were to: (1) determine distribution and abundance of northern anchovies (*Engraulis mordax*), Pacific mackerel (*Scomber diego*), and jack mackerel (*Trachurus symmetricus*); (2) determine amount of recruitment of this year's Pacific sardine (*Sardinops caeruleus*) spawning and measure the population density of older fish; and (3) make incidental collections for taxonomic study.

The survey was conducted by towing a 30-foot midwater trawl for 15 or 30 minutes at predetermined fishing stations. North of Pigeon Point tows were made in daylight to avoid crab fishing gear; south of Pigeon Point tows were made at night. In all, 43 comparable tows were made: 14 daylight tows in the north, and 29 night tows to the south. A special deep-water tow was made in Monterey Bay. An echo-sounder was operated between fishing stations and a visual watch maintained for fish schools.

Much time was lost due to severe weather conditions. Extensive concentrations of jellyfish and salps made shortening most tows to 15 minutes necessary to prevent net damage.

NORTHERN ANCHOVY: Anchovies dominated the catch. Catches were poor in daylight tows north of Pigeon Point, and few concentrations were detected by visual or electronic means. Only 1 adult anchovy and a small quantity of larvae were caught on the 14 stations fished here.

Anchovies were caught in 26 of the 29 night tows made south of Pigeon Point, in numbers ranging from 1 to 3,500 fish. Seventy-eight percent of the catches contained 200 fish or less. The best catches were made between Pfeiffer Point and San Simeon; the echo-sounder also detected the largest number of schools in that area. The anchovy catch consisted almost entirely of large adults averaging approximately 135 mm. (5.3 inches) standard length.

Gonads were examined but no evidence of spawning activity was detected. Night-schooling behavior quite different than found in more

southern waters was indicated by echo-sounder traces. Well-defined compact schools were consistently detected; continuous light scattered traces typical at night in Mexican and southern California waters were almost completely lacking. Compared with this year's surveys in Mexican and southern California waters, anchovies in central California appeared to be less numerous but much larger.

OTHER ACTIVITIES: Only 1 small jack mackerel was taken and no Pacific mackerel or sardines were seen or captured. Other species appearing in the trawl catches included northern midshipmen (*Porichthys notatus*) and California pompano (*Palometa simillima*). The special deep tow caught a variety of deep-sea fish consisting chiefly of lanternfish (family Myctophidae).

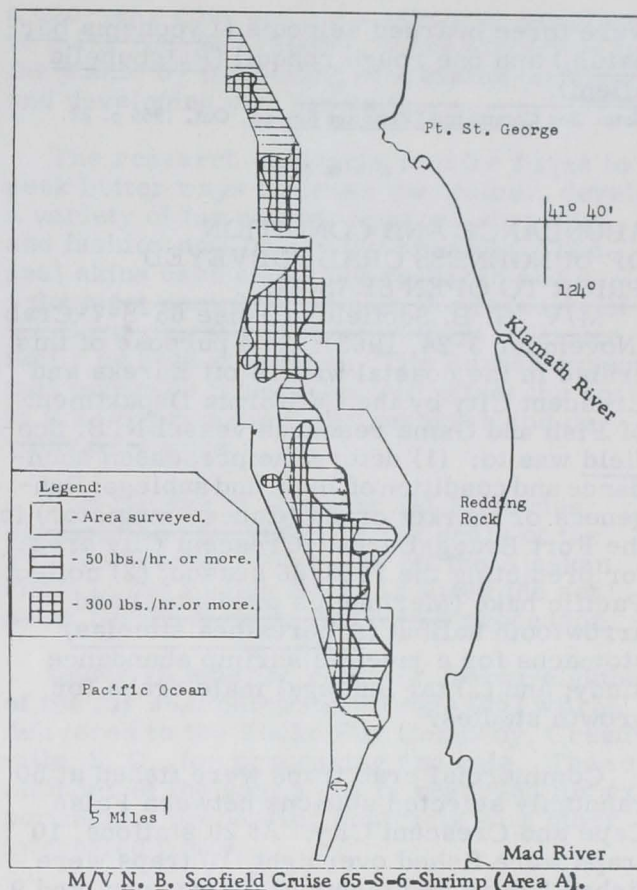
Sea surface temperatures ranged from 14.1° C. (57.4° F.) near Point Reyes to 16.4° C. (61.5° F.) at Coat Oil Point. The Davidson Current was evidenced by warm water, averaging about 14.7° C. (58.5° F.), north of Point Arguello. A series of storms accompanied by gale-force winds prevented a more thorough survey of the area.

Note: See *Commercial Fisheries Review*, Jan. 1966 p. 18.

SURVEY OF SHRIMP RESOURCES IN COASTAL WATERS CONTINUED:

M/V "N. B. Scofield" Cruise 65-S-6-Shrimp (September 27-October 22, 1965):
The objectives of this cruise by the California Department of Fish and Game research vessel N. B. Scofield in the coastal waters off Eureka and Crescent City were to: (1) Sample randomly concentrations of pink shrimp (*Pandalus jordani*) for determining population estimates and natural mortality rates, (2) determine sizes, sexes, and weights of shrimp; (3) save rare or unusual invertebrates and fish for various collections and the State Fisheries Laboratory, Terminal Island; and (4) collect stomachs from Pacific hake (*Merluccius productus*) and arrowtooth halibut (*Atheresthes stomias*) for relative abundance studies of juvenile shrimp.

Three steps of 39 tows each were completed. The tows from each step were distributed at random over the 270-square-mile survey area between the mouth of Mad River and the Oregon border. The average distance of each tow was 1/2 mile and covered



an area of 75,950 square feet (with a net opening of 25 feet). Fishing depths ranged from 38 to 108 fathoms. A semiballoon Gulf of Mexico shrimp trawl with 41-foot headrope and 1-inch stretched mesh was used. A 1/2-inch stretched mesh liner was used in the cod end to prevent escapement of 0-age shrimp.

The 270-square-mile survey area included 171 square miles where 50 or more pounds of shrimp could be caught per hour. It was found that 300 or more pounds per hour (commercial concentration) could be caught in an area of 60 square miles.

The average catch of shrimp per hour, excluding yields under 34 pounds per hour, was 352 pounds (heads on), and ranged from 34 to 1,831 pounds. An estimated 4.6 million pounds of shrimp remain on the bed. The count per pound ranged from 89 to 608, with a mean of 156.

The stomachs of 191 Pacific hake were examined for shrimp and 85 arrowtooth halibut stomachs were collected for examination in the laboratory. Among specimens collected

were three bearded eelpouts (Lycanema barbatum) and one rough ronquil (Rathbunella alleni).

Note: See Commercial Fisheries Review, Oct. 1965 p. 22.

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ABUNDANCE AND CONDITION OF DUNGENESS CRAB SURVEYED PRIOR TO OPEN SEASON:

M/V "N. B. Scofield" Cruise 65-S-7-Crab (November 3-24, 1965): The purpose of this cruise in the coastal waters off Eureka and Crescent City by the California Department of Fish and Game research vessel N. B. Scofield was to: (1) determine pre-season abundance and condition of legal and sublegal Dungeness or market crabs (Cancer magister) in the Fort Bragg-Eureka-Crescent City area for predicting the 1965/66 season; (2) collect Pacific hake (Merluccius productus) and arrowtooth halibut (Atheresthes stomias) stomachs for a juvenile shrimp abundance study; and (3) tag sublegal male crabs for growth studies.

Commercial crab traps were fished at 50 randomly selected stations between False Cape and Crescent City. At 29 stations, 10 traps were fished overnight, 10 traps were fished 2 days and nights at 19 stations, and 9 traps were fished at one station overnight, and at 1 station for 2 days and nights. Bad weather prevented taking of samples north of Crescent City and in the Fort Bragg area.

Shoulder widths of crabs were recorded for the entire catch. Shell condition determinations were made for all male crabs. Sublegal male crabs were tagged with suture tags and released between False Cape and Trinidad.

Trawling for Pacific hake and arrowtooth flounder was not possible due to poor weather.

Two of the 500 traps set were lost and 1 was severely damaged. The remaining 497 traps caught 14,792 crabs, including 12,013 legal males (6¼ inches in breadth or greater), 2,746 sublegal males, and 33 females. The adjusted average catch per trap a day was 20.0 for legal and 4.9 for sublegal male crabs.

The False Cape-Trinidad area averaged 22.3 legal and 8.2 sublegal crabs per trap and Patricks Point-Crescent City area 17.8 legal and 1.7 sublegal crabs. The highest station catch (41.4 legal males per trap) was recorded southwest of Trinidad.

The legal crabs were in poorer condition than in the previous season. Overall, 20.5 percent of the legal males were soft, compared with 7 percent during the 1963/64 season.

Mating marks were noted on 6.5 percent of the sublegal and 0.3 percent of the legal males. None of the females was gravid.

Based on pre-season surveys and season catches for the past 2 years, and this year's survey, the total crab catch for the Fort Bragg-Eureka-Crescent City area should fall between 6.7 and 6.9 million pounds. This would exceed the 20-year average of 6.2 million pounds for the first time since 1961.

A total of 257 sublegal male crabs were tagged and released between False Cape and Trinidad.

Note: See Commercial Fisheries Review, February 1966 p. 15.



Cans--Shipments for Fishery Products, January-November 1965

A total of 2,796,426 base boxes of steel and aluminum was consumed to make cans shipped to fish and shellfish canning plants in January-November 1965 as compared with 2,592,360 base boxes used during the same period in 1964. In 1965, there were increases in the U. S. canned pack of Maine sardines and Gulf shrimp.



Note: Statistics cover all commercial and captive plants known to be producing metal cans. A "base box" is an area 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.



Federal Purchases of Fishery Products

DEPARTMENT OF DEFENSE PURCHASES OF FRESH AND FROZEN FISHERY PRODUCTS, NOVEMBER 1965:

Armed Forces purchases of fresh and frozen fishery products for most major items in November 1965 were generally higher than in November 1964. Purchases were up substantially for flounder fillets, haddock fillets, ocean perch fillets, scallops, oysters, and shrimp.

Principal Fresh and Frozen Fishery Products Purchased by Defense Subsistence Supply Centers, November 1965 with Comparisons

Product	Nov. 1965		Nov. 1964	
	Qty. Lbs.	Avg. Cost Cents/Lb.	Qty. Lbs.	Avg. Cost Cents/Lb.
Shrimp:				
raw headless	132,800	96	96,150	97
peeled and deveined	292,300	133	240,288	133
breaded	367,400	89	341,550	88
molded and breaded	52,928	67	26,300	64
Total shrimp	845,428	104	704,288	104
Scallops	225,600	70	165,200	72
Oysters:				
Eastern	110,087	127	63,340	110
Pacific	26,050	88	26,396	74
Total oysters	136,137	120	89,736	100
Clams	-	-	12,630	35
Cod fillets	37,300	38	23,400	33
Flounder fillets	318,900	42	161,800	31
Ocean perch fillets	372,600	34	259,250	29
Haddock fillets	165,955	40	114,760	33
Haddock portions	52,500	50	131,500	49
Halibut steaks	39,400	63	73,950	48
Salmon steaks	11,375	70	21,110	72
Swordfish steaks	450	68	3,761	58

Compared with the same month in 1964, prices in November 1965 were up for flounder fillets, ocean perch fillets, and haddock fillets.



Fur Seals

INTERIOR DEPARTMENT ISSUES NEW PROPOSALS FOR IMPROVED PROCESSING TECHNIQUES OF ALASKA SKINS:

A second invitation to firms interested in research and development in the processing of Alaska for seal skins was issued December 14, 1965, by the U. S. Department of the Interior. The invitation responded to interest expressed by processors who were unable to reply prior to the closing date for the previous invitation issued in early 1965.

Firms submitting acceptable proposals were to be asked to process sample seal skins to demonstrate their capabilities of performing more extensive research and development work with proposals to be submitted to Interior's Bureau of Commercial Fisheries by January 31, 1966. There are sufficient raw seal skins to support only a very limited number of new research contracts.

In September 1965, the Pierre Laclede Fur Company, St. Louis, Mo., was awarded

a one-year contract for a research program to make Alaska sealskins more attractive to the public by improving processing techniques and developing new products.

The research contracts require firms to seek better ways to dress the leather, develop a variety of fur colors, improve shearing, and fashion new luxury fur products. The seal skins used under the research and development contracts remain the property of the Government and most of them will eventually be sold at auction. The Bureau expects that proceeds from sales will offset the cost to the Government of the research and development work.

The Bureau of Commercial Fisheries manages and harvests the fur seals of the Pribilof Islands, 300 miles off the Alaskan coast in the Bering Sea, and cures the seal skins before shipping them to a processor.

Under an existing contract, seven-eighths of the fur seal harvests through 1967 will be delivered to the Fouke Fur Company, Greenville, S. C., for processing and sale. The remainder of the seal skins is reserved for experimental processing contracts with other interested firms.

Each year the United States harvests about 60,000 surplus young animals, of which about 45,000 processed pelts are sold for the United States account. Under the terms of the North Pacific Fur Seal Convention of 1957, Canada and Japan each receive 15 percent of the annual separate harvests of the United States and the Soviet Union. Alaska receives 70 percent of the net proceeds from the semi-annual fur seal auctions of United States seal skins.

Other seals of the same species breed at rookeries on islands off the coasts of Russia and Japan. Those rookeries are administered by the Soviet Union.

Note: See Commercial Fisheries Review, January 1965 p. 29.



Great Lakes

MICHIGAN PROPOSES CHANGE IN YELLOW PERCH COMMERCIAL FISHING REGULATIONS:

Public hearings were held in January 1966 by fisheries officials of Michigan's Conser-

vation Department to sound out its plans for improving Great Lakes yellow perch populations by liberalizing commercial fishing regulations.

Discussion at the hearing included proposals to remove closed seasons on yellow perch and lift size limits for processed and "in-the-round" perch.

Both of the planned changes were tentatively approved by the Conservation Commission in October 1965. The one dealing with closed seasons is expected to be modified so that an area near Tawas City will remain off limits to commercial perch fishing from June 10 through September 10.

Note: See Commercial Fisheries Review, December 1965 p. 32.



Gulf Fishery Investigations

Some of the highlights of studies conducted by the U. S. Bureau of Commercial Fisheries Biological Laboratory, Galveston, Tex., during October-December 1965.

SHRIMP BIOLOGY PROGRAM: Shrimp Larvae Studies: During the quarter, 41 plankton samples collected in June 1964 were examined for planktonic-stage penaeid shrimp. Planktonic stages occurred in most of the sampling area, but they were about five times more abundant in the waters over the Continental Shelf between Galveston and Port Mansfield than between Galveston and the Mississippi River. The overall abundance of young shrimp, however, was only slightly greater than that observed in May 1964.

Planktonic stages of commercially important shrimp, Penaeus spp., also occurred throughout the study area. They were, however, only twice as abundant in the waters west of Galveston as in the waters to the east. Greatest abundance was in the waters between the 15- and 25-fathom contours. Of the total catch of planktonic-stage Penaeus spp., 21 percent were postlarvae, 22 percent mysids, 46 percent protozoaeae, and 11 percent nauplii. Spawning, indicated by the occurrence of nauplii and protozoaeae in plankton hauls, was not as intensive as in the preceding month.

During the quarter, measuring of all larval stages of Penaeus occurring in plankton hauls was begun in an attempt to differentiate species by length measurements. Adult shrimp, P. aztecus, P. duorarum, and P. setiferus, although possessing similar life histories, generally occupy different bathymetric ranges. Consequently, length measurements of the earliest larval stages (naupliar and protozoal) may vary bathymetrically, thus providing a gross method for larval species differentiation.

Three attempts were made during the quarter to culture pink and brown shrimp larvae in 150-gallon tanks. Although numerous nauplii were obtained, it

was not possible to rear the larvae through the protozoal stage. The major problem has been to supply adequate numbers of diatoms as food for the larvae. During the summer and early fall of 1965, the diatom Skeletonema sp. was grown in 40-liter cultures by adding the metal chelator EDTA to filtered sea water. Starting in October, it was no longer possible to culture Skeletonema in that manner. It was since learned that additions of commercial fertilizers, iron, and EDTA to sea water will support growth of Skeletonema during the fall months.

Tabulation of data on fish caught in experimental trawling operations along the Texas coast during 1962-64 was completed during the quarter. Data were being constructed for a report dealing with the seasonal distribution and abundance of 30 species of fish occurring over the Continental Shelf along the Texas and Louisiana coasts.

Catches of longspine porgy (Stenotomus caprinus) along the Texas coast were usually greatest on the commercial fishery grounds of the brown shrimp. Those catches were usually in excess of 100 pounds an hour trawled and were made at 15-, 25-, and 35-fathom stations. No species dominated the fish catches made on the white shrimp grounds (shallower than 10 fathoms) off Texas.

Cultivation of Shrimp in Artificial Ponds: One problem encountered during the first experiments to rear shrimp in seminatural ponds was that of obtaining and stocking large numbers of postlarvae collected in the Galveston Pass without also stocking many shrimp predators. To eliminate those problems, attempts were made to obtain a spawn by placing gravid pink and brown shrimp females in the static-water pond and rearing the resulting young through the larval stages. In each of three attempts, recaptured females had spent ovaries the day following their release. Subsequent sampling for eggs and nauplii, however, was unsuccessful.

In another experiment, several thousand pink shrimp nauplii, which had hatched under laboratory conditions, were also put in the static-water pond. They, too, failed to survive. Failure in the initial trials can, in part, probably be attributed to the entanglement of eggs and nauplii in phytoplankton and bottom detritus. Similar results have been observed in laboratory experiments, but they have been eliminated by constant aeration.

During the initial growth studies conducted between March and October 1965, a high mortality of shrimp was noted in the static-water pond following applications of fertilizer. Tests were conducted to determine the toxicity of fertilizers to shrimp and the optimum level of fertilizer necessary for lush plankton growth. The results of the tests will be used as guides for applying fertilizers during the 1966 growth studies.

Movements, Growth, and Mortality of Commercial Shrimps: A mark-recapture experiment was begun on the Florida Tortugas grounds during October to collect additional growth and mortality data on pink shrimp. Three groups of shrimp, representing restricted size ranges (small, medium, and large), were stained with distinctive dyes and released near the center of the fishery. Of the 7,199 shrimp released, 1,024 (14 percent) were recovered. In spite of careful planning prior to the experiment, it is doubtful that the results will be suitable for determinations of mortality rates. It is suspected that significant numbers of stained

shrimp were not detected because unusually good catches forced processors to ship landings to distant plants before they were examined for marked shrimp.

The white shrimp marking experiments conducted in Galveston Bay, Tex., during July and August were completed by the end of 1965. About 10 percent (959 shrimp) of the stained shrimp were returned. Preliminary analysis of the recovery data indicates a dispersion of the marked groups throughout Galveston and Trinity Bays. During the latter stages of the experiment, a seaward movement took place and 12 stained shrimp were recovered from the Gulf.

Commercial Catch Sampling: Studies designed to evaluate the reliability of shrimp landings statistics continued during the quarter. An indication of the variation present in estimates of the size composition of shrimp landings and in the catch per unit of effort by commercial trawlers was obtained by comparing data collected at Freeport and Aransas Pass, Tex., for July through November. Only minor differences were evident in the estimates when fleets from the two ports fished in the same area, indicating that the sampling procedures are reliable.

Laboratory personnel spent considerable time during the quarter taking various shrimp measurements which will be used to establish accurate means for converting length to weight and tail length to total length. These relations are being developed for each sex of the three commercial species of shrimp.

Three additional sampling agents of the Bureau temporarily stationed at Key West and Marathon, Fla., obtained interviews from 85 percent of 937 landings there during October and November. Approximately 600 interviews were obtained by samplers at Freeport and Aransas Pass, Tex., during the same period.

Surveys of Postlarval Abundance and Fisheries for Bait (Juvenile) Shrimp: Routine sampling for postlarval shrimp continued during the quarter at four locations along the Texas coast. With the advent of winter, however, reduced numbers of postlarvae were collected at all stations. Additional tows were made in September to determine whether or not postlarvae tend to skirt the main current when moving through the tidal pass. Collections were taken with a small beam trawl in progressively deeper water beginning at the shoreline of the pass. Results obtained agreed with those from sampling of this type conducted in spring 1964 when it was learned that decreasing numbers of postlarvae occurred with increasing depth from the shoreline toward the channel.

Trawling for juvenile brown and white shrimp for growth data continued on a weekly basis. The Swan Lake sampling site was abandoned in late October following a major fish kill in the area, but weekly trawl hauls continued at a new site in Moses Lake. Juveniles of both species became scarce in late December.

Weekly sampling of the bait shrimp fisheries of Galveston, Aransas Pass, and Pt. Isabel for species composition information continued during the quarter. The 1965 crop of juvenile brown shrimp remained in Galveston Bay longer and accounted for a higher percent of the commercial bait catch than in 1964. Also, bait shrimp production was 47 percent higher for October and November in 1965 than in 1964.

EXPERIMENTAL BIOLOGY PROGRAM: **Behavior and Ecological Parasitology:** A previous report described burrowing of brown shrimp postlarvae in response to experimentally reduced temperature. This type of behavior, previously unknown for postlarval shrimp, occurred at 12° to 16½° C. (53.6° to 61.7° F.) in the laboratory. According to field observations from workers in the Bureau's Shrimp Biology and Shrimp Dynamics Programs, in nature the numbers of postlarvae collected in the water column per unit effort are quite small when water temperatures are in that range.

Subsequent laboratory results reveal the crustaceans leave their burrows as the temperature increases. This response was observed most frequently in the temperature range of 18° to 21½° C. (64.4° to 68.9° F.). Field workers in the northwestern Gulf of Mexico have noted that the major influx of brown shrimp postlarvae occurs in the early spring when water temperatures have reached that range.

Information is needed to determine how postlarvae move from offshore spawning areas to bay nursery areas. As part of an effort to investigate the problem, six experiments were made intended to estimate the ability of postlarval brown shrimp to swim continuously. For the 56 specimens studied as of that time, individual swimming stamina ranged from 0.0 to 10.5 days of uninterrupted swimming. The mean value was 2.8 days.

Considerable variation in performance between groups of postlarvae seems to be related to their tendency to jump out of experimental containers. Groups in which jumping out was common had the highest mean values for swimming stamina. It is possible that this relation could provide a basis for a method by which the condition of live shrimp could be evaluated.

Identification and enumeration of parasites from samples of shrimp from several Texas bays was continued during the quarter. The latest results showed that the trematode, *Opecoeloides fimbriatus*, is a common parasite in some bays and uncommon in others. Hence, this worm may be useful in tracing shrimp to their nursery areas.

Growth and Survival Studies: An experiment was conducted during the quarter to determine the suitability of fish protein concentrate (fish flour) as food for juvenile and subadult shrimp. Twenty juvenile white shrimp were isolated in 10-gallon aquaria, one per container. During the 27-day experimental period, one group of 10 shrimp was fed the flour and the second group was fed frozen adult brine shrimp. No deaths occurred in either group. As in an experiment previously conducted with brown shrimp, growth of animals fed frozen brine shrimp surpassed those fed the flour. There was a 54-percent weight increase in the group receiving brine shrimp compared with a 29-percent weight increase in the fish flour group.

Experiments were also conducted with postlarvae reared in the laboratory by the staff of the laboratory's Shrimp Biology Program. In one experiment, the effect of temperature on postlarval seabobs was tested using growth as an indicator. Four temperatures were tried--11°, 18°, 25°, and 33° C. (from 51.8° to 91.4° F.). Two hundred animals were involved--50 at each temperature level. Salinity in each instance was 29 p.p.t., the salinity to which the shrimp were accustomed. Growth was best at the two higher temperatures, as

evidenced by increases in weight of 273-fold at 33° C. (91.4° F.) and 167-fold at 25° C. (77° F.). At 18° C. (64.4° F.), there was only a 13-fold weight increase. There were no survivors after the 4th day at 11° C. Though the growth of survivors was greatest at 33° C., survival was poor. Only 23 percent of the test animals survived at that temperature as compared with 56 percent at 25° C. Survival was also low (23 percent) at 18° C.

In a second experiment, laboratory-reared, post-larval pink shrimp were exposed to various levels of temperature and salinity to provide short-term survival data for comparison with that previously obtained with brown shrimp. At the low salinities, 10 p.p.t. or less, the pink shrimp did not survive as well for 24 hours as the browns at any temperature tried--7°, 15°, 25°, 33° C., or 36° C. (from 44.6° to 96.8° F.). At 25 p.p.t. survival was good with 85 percent surviving at 36° C. and 100 percent at the other temperatures (7°, 25°, and 33° C.).

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



Industrial Fishery Products

U. S. FISH MEAL AND SOLUBLES:

Production and Imports, January-November 1965: Based on domestic production and imports, the United States available supply of fish meal for the first 11 months in 1965 amounted to 480,274 short tons--138,564 tons (or 22.4 percent) less than during the same period in 1964. Domestic production was 3,095 tons (or 1.4 percent) higher, but im-

Item	Jan.-Nov.		Total 1964
	1965	1964	
. . . (Short Tons)			
<u>Fish Meal and Scrap:</u>			
<u>Domestic production:</u>			
Menhaden	165,675	155,302	160,349
Tuna and mackerel	24,654	19,239	21,113
Herring	12,050	8,781	8,881
Other	18,204	34,166	44,909
<u>Total production</u>	<u>220,583</u>	<u>217,488</u>	<u>235,252</u>
<u>Imports:</u>			
Canada	40,046	50,247	54,769
Peru	206,006	319,144	348,025
Chile	5,201	11,407	12,942
Norway	78	-	-
So. Africa Rep.	3,600	15,834	18,581
Other countries	4,760	4,718	4,826
<u>Total imports</u>	<u>259,691</u>	<u>401,350</u>	<u>439,143</u>
<u>Available fish meal supply . .</u>	<u>480,274</u>	<u>618,838</u>	<u>674,395</u>
<u>Fish Solubles:</u>			
<u>Domestic production</u>	<u>91,019</u>	<u>90,557</u>	<u>93,296</u>
<u>Imports:</u>			
Canada	1,373	1,390	1,553
So. Africa Rep.	-	935	987
Other countries	3,650	1,903	1,965
<u>Total imports</u>	<u>5,023</u>	<u>4,228</u>	<u>4,505</u>
<u>Available fish solubles supply</u>	<u>96,042</u>	<u>94,785</u>	<u>97,801</u>

ports were 141,659 tons (or 35.3 percent) lower than in January-November 1964. Peru continued to lead other countries with shipments of 206,006 tons.

The United States supply of fish solubles during January-November 1965 amounted to 96,042 tons--an increase of 1.3 percent as compared with the same period in 1964. Domestic production and imports of fish solubles increased 0.5 percent and 18.8 percent, respectively.

* * * * *

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

Production, November 1965: During November 1965, a total of 10,995 tons of fish meal and about 8.2 million pounds of marine-animal oil was produced in the United States. Compared with November 1964, this was an increase of 263 tons of fish meal but a decrease of 66,000 pounds of marine-animal oil. Fish solubles production amounted to 4,328 tons--an increase of 562 tons as compared with November 1964.

Product	Nov.		Jan.-Nov.		Total 1964
	1965	1964	1965	1964	
. (Short Tons)					
<u>Fish Meal and Scrap:</u>					
Herring	249	405	12,050	8,781	8,881
Menhaden 2/	8,072	7,154	165,675	155,302	160,349
Tuna and mackerel	1,997	2,026	24,654	19,239	21,113
Unclassified	677	1,147	18,204	34,166	34,809
<u>Total 3/</u>	<u>10,995</u>	<u>10,732</u>	<u>220,583</u>	<u>217,488</u>	<u>225,152</u>
<u>Fish Solubles:</u>					
Menhaden	2,888	2,372	71,575	67,045	68,738
Other	1,440	1,394	19,444	23,512	24,558
<u>Total</u>	<u>4,328</u>	<u>3,766</u>	<u>91,019</u>	<u>90,557</u>	<u>93,296</u>
. (1,000 Pounds)					
<u>Oil, body:</u>					
Herring	178	365	7,526	10,261	10,354
Menhaden 2/	6,683	7,339	169,680	152,437	157,730
Tuna and mackerel	766	447	5,094	4,598	4,816
Other (inc. whale)	610	152	5,273	7,160	7,298
<u>Total</u>	<u>8,237</u>	<u>8,303</u>	<u>187,573</u>	<u>174,456</u>	<u>180,198</u>

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.



New England

FORECAST OF GROUND FISH AND SEA SCALLOP ABUNDANCE IN 1966 ON NEW ENGLAND FISHING BANKS:

The abundance of the various species of groundfish and sea scallops fished by New

England fishermen will show no drastic changes during 1966, according to the Director of the North Atlantic Region of the U. S. Bureau of Commercial Fisheries. The forecast is based on information provided by biologists of the Bureau's Woods Hole Biological Laboratory who monitor the landings of commercial fishermen and study, by sampling, the populations of fish and shellfish on offshore fishing banks with the Bureau's fishery research vessel Albatross IV.

Haddock landings in New England in 1965 totaled about 115 million pounds--down 2 million pounds from 1964. The decrease in landings in 1965 was due to markedly lowered catches from Browns Bank and the Gulf of Maine; landings from Georges Bank increased by 9 million pounds.

The very abundant 1963 year-class of haddock found by the Albatross IV in its annual fall survey in 1963 started entering the Georges Bank fishery as small scrod in 1965 and will remain a dominant year-class during 1966. As a result, 1966 will be an excellent scrod year on Georges Bank. Surveys by the Albatross IV indicate that the two following year-classes (1964 and 1965) are small ones so the Georges Bank fishery will depend primarily on the single 1963 year-class for two more years.

On Browns Bank the 1963 year-class will not appear in the landings until 1967 because of the slower growth rate on that bank. The appearance there will come at a time when abundance may be somewhat reduced on Georges Bank.

Landings of cod in 1965 were about 30 million pounds, down from the 32 million pounds landed in 1964. This was due to decreased fishing since the abundance index for cod in the areas fished was the same in 1965 as in 1964. In 1966 the abundance is expected to hold steady.

Yellowtail flounder have been unusually abundant in recent years. Landings reached a peak of 79 million pounds in 1964. In 1965 the landings dropped to 76.5 million pounds. The incoming year-classes appear to be smaller than in recent years so that abundance is expected to drop somewhat further in 1966.

United States landings of whiting (silver hake) dropped sharply from the 87 million

pounds landed in 1964 to 76 million pounds in 1965. Both U. S. and Soviet fishermen fished for that species. The Soviets fished Georges Bank while U. S. fishermen fished primarily other areas such as along the Maine Coast, in Cape Cod Bay, and off Nauset. Abundance in those latter areas in 1965 was lower than in 1964 and there is no reason to believe the situation will improve significantly in 1966.

Ocean perch (redfish) landings in the United States in 1965 totaled about 80 million pounds--down from the 89 million pounds landed in 1964, and the lowest since 1939. The drop was due to a poor market for that species as abundance increased in all areas normally fished by U. S. fishermen, from the Gulf of Maine to the Grand Bank of Newfoundland. Abundance of that species in 1966 is expected to continue to increase over the 1965 level.

United States landings of sea scallop meats in 1965 totaled about 19.5 million pounds as compared with 15.5 million pounds in 1964. Abundance of sea scallops on Georges Bank, the principal fishing grounds, has declined in recent years, but total landings were maintained in 1965 by diversion of some effort to the Middle Atlantic grounds. Abundance on Georges Bank during 1966 is expected to hold at the 1965 level or slightly below.



North Atlantic

SOVIET FISHING ACTIVITY OFF COAST, JANUARY 1966:

There was a substantial increase in Soviet fishing activity in the Northwest Atlantic dur-



Fig. 1 - Soviet tug Sterequshchii making repairs to Soviet trawler Perekop in Cape Cod Bay.

ing January 1966. A sizable fleet of large conventional side trawlers returned to Georges Bank from U. S. S. R. ports and from other fishing areas. Several processing vessels of recent construction were also observed.



Fig. 2 - Departing Soviet trawler Perekop after completion of inspection by U. S. Government employees.

In all, a total of 49 vessels were sighted and identified as 24 fish-factory stern trawlers, 5 processing and refrigerated freezer stern trawlers, 16 large refrigerated side trawlers, 2 fish transports, and 2 fuel and water carriers.

The Soviet vessel observations were made by the staff of the Fisheries Resource Management Office, U. S. Bureau of Commercial Fisheries, Gloucester, Mass., which conducts reconnaissance flights cooperatively with the U. S. Coast Guard.

Despite severe weather conditions which prevailed during most of the month, the majority of the vessels were actively fishing. The vessels were divided into small groups and were widely dispersed from south of Montauk Point, Long Island, eastward along the 100-fathom curve of the Continental Shelf to the southeast part of Georges Bank.

The factory stern trawlers were operating primarily in areas ranging from 60 miles south of Block Island to 30-40 miles south and southeast of the Nantucket Lightship. Heavy to moderate catches of fish on deck and in the trawls appeared to be primarily red hake and whiting, with undetermined quantities of haddock. The Soviets had much success in fishing for red hake in those general areas commencing about this time in 1965.

Large refrigerated side trawlers, several support vessels, and one large factory base ship were operating on the southeast part of Georges Bank 100 miles southeast of Cape Cod. The heavy catches of fish appeared to be mostly haddock, with lesser amounts of whiting. Crews on deck were dressing fish which are bagged in sections of netting and transferred to a nearby processing ship.

The southeast part of Georges Bank has been an extremely productive area for scrod haddock and was fished almost entirely by the U. S. fleet during 1965.

At the end of January there were only a limited number of Soviet vessels operating off the eastern Nova Scotia areas.



Fig. 3 - U. S. Government fishery resource management official inspecting section of netting on board Soviet trawler Perekop during boarding in Cape Cod Bay.

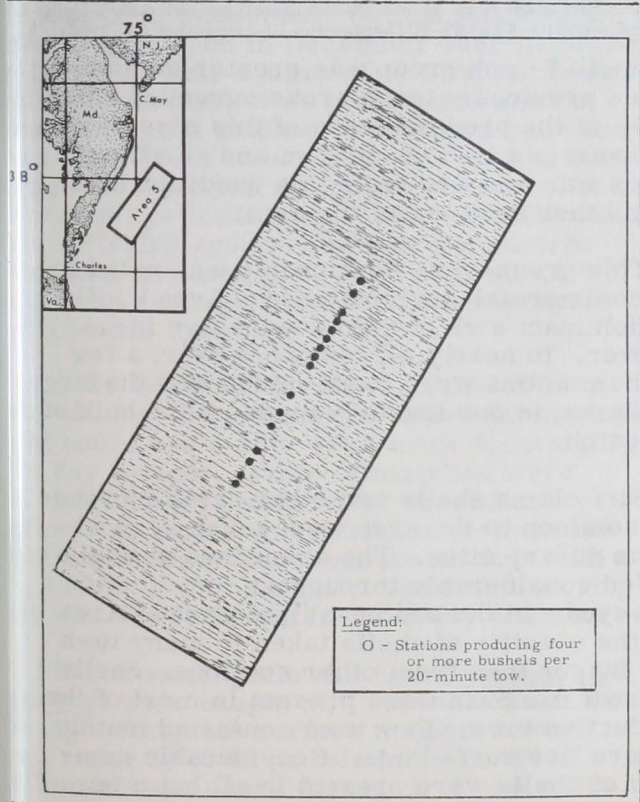
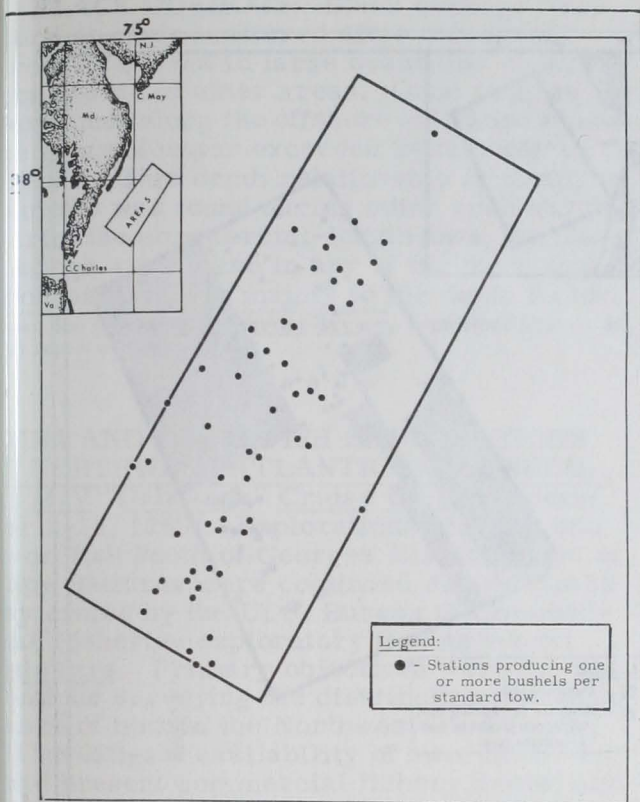
The Soviet salvage tug Steregushchii towed the Perekop (a 229-foot, 658-gross ton, steam-driven, conventional side trawler) into shelter of Cape Cod Bay in order to make emergency repairs. The vessels were boarded by U. S. Government employees.



North Atlantic Fisheries Explorations and Gear Development

SURF CLAM SURVEY CONTINUED:

M/V "Delaware" Cruise 65-10 (September 10-November 24, 1965): Continuation of an Atlantic surf clam survey conducted during the summer of 1963 and 1964 was the purpose of this cruise by the U. S. Bureau of Commercial Fisheries Exploratory fishing vessel



Delaware off the coasts of Maryland and Virginia. The survey was initiated in cooperation with the Sea Clam Packers Committee of the Oyster Institute of North America.

The remaining unexplored section of Area V and most of the unexplored sections of Area VI were completed. Of the 716 stations occupied, 194 tows were made where the catches of surf clams from the standard 4-mile tow equaled up to 3.6 bushels. The 53 commercial-length tows yielded up to 16.3 bushels in 20-minutes.

SURVEY PROCEDURES: The same procedure was used as that of past clam surveys. At each intersection of one-mile spaced grid lines, samples were taken by dredging the bottom with a 48-inch hydraulic dredge. Dredging was continued for 4 or 2 minutes depending upon the type of bottom soil in the towing area. To obtain commercial-size samples, tows of 20 minutes were made continuously along a selected grid line in Area V. This was done by returning the dredge to the bottom after each tow and fishing it without intervals of nondredging between stations.

All stations surveyed in Area VI, except for several made along the central part of the first four inshore grid lines, were in the southeast quadrant of the area. The section just north of this quadrant was bypassed because of danger from unexploded mines in the area.

Isolated stations in area V that were bypassed in previous surveys, in addition to grid lines 13, 14, 15, 16, 17 and 18, were completed by the end of the cruise. That completes the planned survey work in Area V.

SURF CLAM CATCHES: Of the 663 standard tows conducted during the cruise in both areas, the catch from 18 equaled or exceeded one-quarter bushel per minute of towing time and included a maximum catch rate of 0.9 bushels per minute. Of the 645 remaining tows, 250 of them yielded from 1 clam to 1 bushel. The remaining 395 tows yielded no clams. In the commercial group (53 tows), 16 tows yielded catches of 4 or more bushels per 20 minutes of towing time. One sample of the 53 contained no clams, leaving 36 tows where the catch varied from a few clams to 4 bushels. A higher percentage of zero catches was made during this cruise than previous cruises in the two areas; about half of the sur-

Fig. 1 - Surf clam Area V and producing stations during M/V Delaware Cruise 65-10 (September 10-November 24, 1965).

vey work was carried out near positions where poor results were obtained previously.

The best concentrations of surf clams were found in the southeast quadrant of Area VI. Larger catches were made at the northeast part of that quadrant and few clams were taken elsewhere in Area VI. No new beds were found in Area V where the population of surf clams was large enough to be significant for commercial utilization. Only 2 stations, one each on grid lines 1 and 18, of Area V yielded catches equal to one-quarter bushel per minute of towing time. Stations surveyed along the inshore grid lines of both areas yielded poor catches (similar to those taken previously in the same general location). Results from the offshore grid lines were about the same as those of the previous cruises--where depth of water exceeded 20 fathoms, few or no surf clams were found. In the commercial towing section of Area V, the best catches were made along the section of grid line 10 lying between Loran bearing 1H4-2629 and 1H4-2862. It was there, along grid line 10, that good catches of surf clams were taken during cruise 65-2 in standard 4-minute survey tows. Those results validate the 4-minute tow as a resource-assessment method.

Throughout all sections surveyed, the size and occurrence of the catches varied with the type of bottom. Best results were obtained where the bottom was coarse sand, gravel, or a combination of both. Tows made on soft or rocky bottom did not yield as good results as other bottom types. It was noted that poor catches were made in what was considered good bottom soils.

Water depth is a factor to consider in the analysis of the catch. The best catches were made in depths of 16 to 20 fathoms in agreement with previous findings. A small number of good catches was made in shallower water. The commercial-length tows showed the same relationship. The shallow waters below 16 fathoms and deep waters below 20 fathoms yielded poor results.

SIZE OF SURF CLAMS: All sizes of surf clams, except those which are too small for the dredge to retain, were taken during the cruise. As found for all previously surveyed sections, the predominant size group was 5 to 7 inches and larger. In the southeast quadrant of Area VI, the proportion of clams in

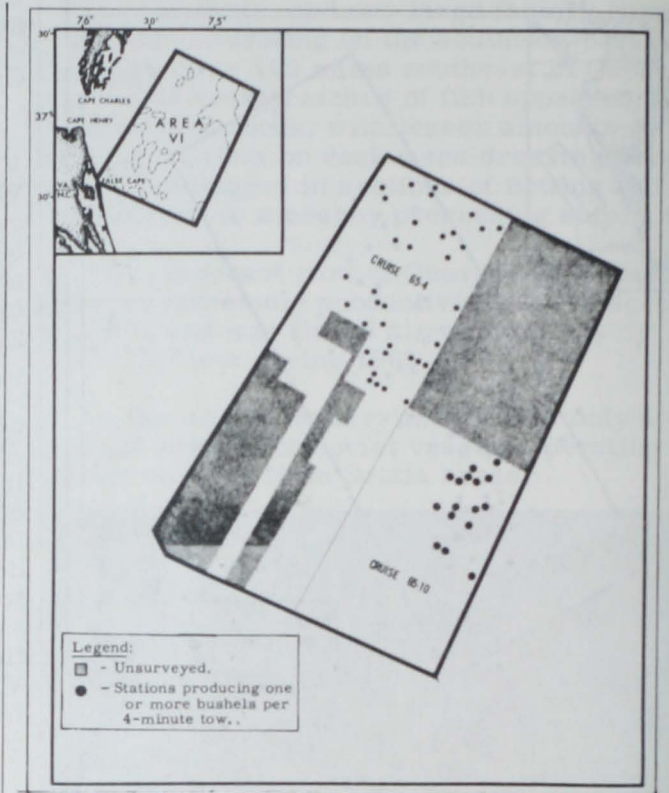


Fig. 2 - Surf clam Area VI and producing stations during M/V Delaware Cruises 65-4 and 65-10 (September 10-November 24, 1965).

the 6- to 7-inch group was greater than obtained previously in all areas surveyed. Because of the predominance of this size group, the average catch of medium and small surf clams was smaller from this quadrant than from other sections of the area.

This group-size relationship was noted in the commercial-scale catches of Area V. The predominant size of clams were five inches or over. In nearly all tows, however, a few medium clams were found mixed with the larger clams; in one tow they made up the bulk of the catch.

Surf clams shells and other shellfish species common to the area were taken at most of the survey sites. The abundance of shells varied considerably throughout each section surveyed. In the southeast quadrant of Area VI, the quantity of shells taken in many tows was larger than from other sections. Shells in great numbers were present in most of the productive tows. Few tows consisted mainly of pure live surf clams. Considerable numbers of shells were present in all but a few tows made in the commercial-sampling area.

BLACK QUAHOGS: Black quahogs were found at many scattered sites throughout Area VI, but not in large quantities equal to those found in other areas. Good catches were made along the offshore grid lines where the depth of water exceeded 24 fathoms in Area V. This depth relationship is about the same as was found during other cruises. During the commercial-length tows, few black quahogs were taken in any of the tows, this probably was due mainly to the depth factor.

Note: See Commercial Fisheries Review, September 1965 p. 34, for report on Cruise 65-4.

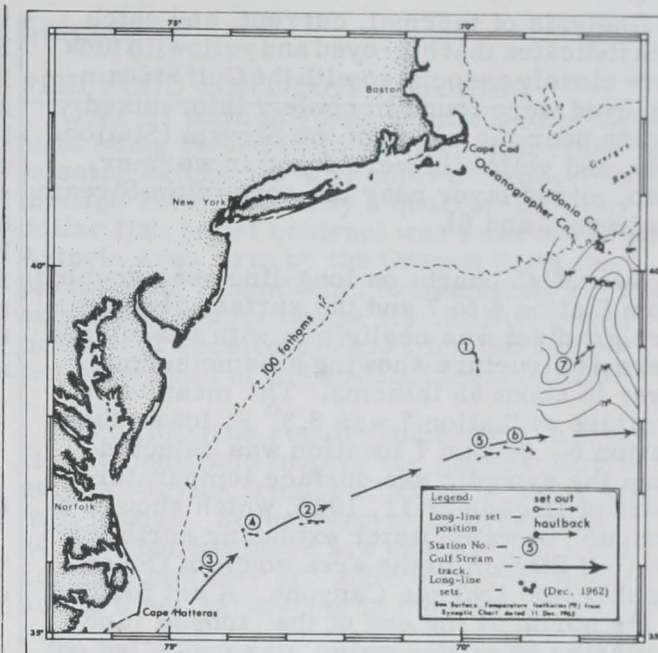
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TUNA AND SWORDFISH EXPLORATIONS IN NORTHWEST ATLANTIC CONTINUED:

M/V "Delaware" Cruise 65-13 (December 2-13, 1965): Explorations for tuna and swordfish south of Georges Bank and east of Cape Hatteras were continued during this 12-day cruise by the U. S. Bureau of Commercial Fisheries exploratory fishing vessel Delaware. Primary objectives were to: (1) continue surveying the distribution and abundance of tuna in the Northwestern Atlantic, (2) investigate availability of swordfish beyond present commercial fishery areas, and (3) examine the relationship of thermal environment to availability of tuna and swordfish. Exploration in December 1965 included 16 long-line sets southeast of Georges Bank with good catches of swordfish and bluefin tuna, and small catches of big-eyed and albacore tuna. This information clarifies and enlarges the seasonal distribution picture for swordfish, yellowfin, big-eyed, and albacore tuna. Fishing results and thermal environment data obtained gave good indications of swordfish concentrations off Oceanographer and Lydonia Canyons.

LONG-LINE SETS AND CATCH: Three sets of long-line gear were fished during daylight hours and 4 sets were made from night into day periods. Units of mainline were 20-fathoms long with hooks spaced every 20 fathoms on 5-fathom branchlines. Each 10-hook unit was buoyed from the surface with a 1-, 10- or 20-fathom line. Squid and herring bait was used alternately on every other unit.

Fifteen small yellowfin tuna (Thunnus albacares) were caught at 2 stations (5 and 6) having the highest surface temperatures--size range 20 to 32 pounds (round). Five yellowfin were shark damaged. Catch rates were low (1.0 and 1.5 fish per 100 hooks) and did not indicate concentrations. Small school



Station pattern of M/V Delaware Cruise 65-13 (Dec. 2-13, 1965).

tuna (thought to be yellowfin) were observed surfacing alongside and in the vessel's wake during a 20-minute haulback period at Station 6. With the exception of 1 big-eyed tuna (Thunnus obesus) weighing 19¼ pounds (round), the weight range was 60 to 186 pounds and the average was 125 pounds. One albacore (Thunnus alalunga) weighing 28 pounds was caught at Station 7.

Nine of the 11 swordfish (Xiphias gladius) caught on long-line gear were at Stations 6 and 7. Average size of the fish was 83 pounds ranging from 24 to 135 pounds. Two larval swordfish were taken in a surface plankton net at Station 5. Other noteworthy long-line catches included 2 blue marlin (Makaira nigricans), 1 opah (Lampris regius), and 4 gempylids (Lepidocybium flavo-brunneum).

ENVIRONMENTAL RELATIONSHIPS: Thermal data used during the cruise were: (1) synoptic sea surface temperature isotherm and layer-depth isopleth data received from the U. S. Naval Oceanographic Office by radio-facsimile equipment aboard the vessel, (2) continuous sea surface temperature recordings, and (3) vertical (subsurface) temperature profile data obtained with bathythermograph (BT) equipment. Current observations were made from speed and direction of gear drift during fishing periods.

Analysis of thermal, current, and catch data indicates that big-eyed and yellowfin tuna were closely associated with the Gulf Stream--big-eyed were found in cooler, thin, mixed layers near the edges of the Stream (Stations 2-4), and yellowfin were found in warmer, deep, mixed layer near the core of the Stream (Stations 5 and 6).

Swordfish caught on long-line gear doubled from Station 6 to 7 and the surface temperature gradient was negligible, with subsurface thermal structure showing a homothermal layer to about 55 fathoms. The mean temperature at Station 7 was 8.3° F. lower than Station 6. Station 7 location was selected from the synoptic sea surface temperature chart of December 11, 1965, which showed a "tongue" of warm water extending north from the Gulf Stream to the area south of Oceanographer and Lydonia Canyons. A set further to the north, at the end of the "tongue" and bordering on colder water, was cancelled out by bad weather. A bathythermograph (BT) transect of the northwestern edge of the "tongue" indicated a complex subsurface temperature structure with underlying layers of warmer water. Similar structures in that area were noted in December 1962 when Woods Hole Oceanographic Institution's exploratory long-line catch rates averaged 7.9 swordfish per 100 hooks over nine sets. North of the area (500 fathoms in Oceanographer Canyon) the vessel ran through surface schools of saury (*Scomberesox saurus*) for two hours with the same bait noted in the stomach contents of swordfish taken at Station 7. No fishing vessels were seen in that area.

FISHING DEPTH OF LONG-LING GEAR:

Depth of the center of the mainline curve (catenary) between buoylines (220 fathoms apart) was examined using 500-foot bathythermograph recorders with 12-hour clocks. Records made by those instruments revealed greater fishing depth of the gear than expected. Long-line sets, in general, fished deeper near the ends of the gear. During most sets the gear did not fish at a constant depth but slowly descended until hauled. The effect of current upon gear depth caused radical variations. Preliminary review of the recordings suggests that buoyline length has less effect on long-line fishing depth than distance between buoys and current velocity.

OTHER ACCOMPLISHMENTS AND OBSERVATIONS: In cooperation with the Woods

Hole Oceanographic Institution and the Shark Research Panel of the American Institute of Biological Sciences, 2 big-eyed tuna, 1 blue marlin, and 68 sharks were tagged and released. Physiological (body temperature regulation) data were collected on big-eyed and yellowfin tuna, swordfish, blue marlin, mako and silky sharks by personnel from the Woods Hole Oceanographic Institution. Ten experimental semiautomatic branchline clips were successfully tested for manual application in the fishing operation.

Note: See Commercial Fisheries Review, Nov. 1965 p. 27.



Oregon

WILLAMETTE RIVER SILVER SALMON COUNT RESUMED IN 1965:

Counts of adult silver salmon passing over Willamette Falls during the 1965 season were 47 percent greater than the previous high recorded in 1957, according to the Oregon Fish Commission. The run size calculation is based on actual counts of fish passing through the old Willamette Falls ladder during sample periods. This figure is then expanded to cover a full 24-hour day. On this basis, the 1965 run was calculated to total 10,300 silver or coho salmon, consisting of 7,800 3-year-olds and 2,500 2-year-olds or jacks.

Counting of the Willamette River silver salmon run was first started during the 1954 season and it continued through 1960. The counting was done each of those years during identical daily, 8-hour, daylight periods when the silver salmon were in the river. Lack of funds for the program precluded counting activities during the 1961-64 period. In 1965, with Columbia River Fishery Development Program funds provided through the U. S. Bureau of Commercial Fisheries, an extensive, one-year silver salmon counting project was set up at the falls. It is hoped a continuing program can be financed which will provide a basis for evaluating the efficiency of the proposed \$2.2 million Willamette Falls fishway in passing the runs of silver salmon into Willamette system.

Because of extremely low flows during the upriver migration period during the fall of 1965, temporary repairs to the existing ladder were required to enable silver salmon to use the facility. Counting began on September 2 and continued through December 20, with the

peak movement observed during October 22-27.

The total 1965 run figure is not readily comparable with figures obtained in earlier years since the season's activities were much more intensive. The best comparison under these circumstances is obtained by considering counts made in 1965 during exactly the same 8-hour, daylight periods that counting was conducted in the 1954-1960 years. On this basis the 8-hour count shows 4,360 3-year-old silver salmon for the 1965 season compared with the previous high of 2,950 adults in 1957. The 7-year average for the 1954-60 period was 1,311 adult fish.

The counts of early maturing male fish that return at two years of age have been higher in former years but this group of fish has little effect on the production of silver salmon from the river above the barrier. However, the size of 2-year-old returns is often an indication of the magnitude of the run of 3-year-old adults expected in the following year.

The greater numbers of silver salmon in the Willamette run appear to reflect increased Oregon Fish Commission efforts in introducing both fingerling and fry silver salmon into various Willamette tributaries. In the last two years adult fish, surplus to Fish Commission hatcheries, have been transplanted in order to help realize the potential for that species in the Willamette system. Success of these introductions gives grounds for considerable optimism over the possibility for developing a large run of silver salmon in the Willamette River when the much-discussed Willamette Falls fish ladder becomes a reality. Construction of the huge ladder will get underway early this spring when the troublesome cul-de-sac portion at the west end of the falls is started. Fishery biologists believe that eventual completion of the project could raise the potential anadromous fish escapements above the falls of the Willamette River to as high as 285,000 salmon and steelhead, some 90,000 of which would consist of silver salmon. Such dramatic increases in production would bode well for the future success of sportsmen and commercial fishermen alike.



Salmon

FISH FOOD CONTRACT AWARDED

Over 37 million young salmon and steelhead being raised in 15 Oregon Fish Commission hatcheries will enjoy a balanced diet through 1966. Recently a quarter-million-dollar fish pellet contract was awarded to an Astoria area firm by the Oregon State Department of Finance and Administration. The successful bidder on the 1.8-million-pound order will receive \$252,252 for the completed shipments of the specialized fish food.

Specifications require adherence to a precise formula and involve the manufacture of pellets varying from $\frac{1}{32}$ of an inch to $\frac{1}{8}$ of an inch in size. Seventy-seven deliveries of 24,000 pounds apiece are specified by the contract and they are scheduled over the season to 8 key hatcheries in the State. The U. S. Fish and Wildlife Service, Washington Department of Fisheries, Washington Department of Game, Idaho Department of Fish and Game, and the Oregon Game Commission have also placed substantial orders with the same firm in past years. Over 7 million pounds of the specialized fish food will be used this year in the 3 Northwest States.

The pellet was developed jointly by Oregon State University and Oregon Fish Commission scientists and has since become the predominant diet fed to hatchery-produced salmon in the Northwest. Increasing numbers of steelhead trout are also being switched to the pellet. The ration is a pelletized fish food which was developed to best utilize both the nutrition and cost benefits available in fresh fishery waste products. These are combined with dry ingredients to produce a food that has from 30 to 35 percent moisture content. The pellet presently being fed shows excellent nutritional advantages as well as being readily acceptable to the young fish. An additional advantage lies in being able to combine drugs or antibiotics into the pellet during manufacture, thus allowing treatment of disease as a part of the regular diet when needed.

Along with improved hatchery techniques in general, the pellet has had a profound influence on the ability of hatcheries to produce dramatic returns of silver or coho salmon and thereby greatly supplement the runs of this species which are harvested by sportsmen and commercial fishermen alike.



South Carolina

FISHERIES BIOLOGICAL RESEARCH PROGRESS, OCTOBER-DECEMBER 1965:

A report on the progress of biological research by the Bears Bluff Laboratories, Wadmalaw Island, S. C., for October-December 1965, follows:

Oyster Studies: A State-Federal deep-water oyster project surveyed 27 lineal miles of creeks and rivers locating existing and potential oyster beds. A small planting of seed oysters from the Wando River was moved to deep water in the Toogoodoo River where somewhat comparable hydrographic conditions existed. Inspection of those oysters three months later showed that survival was good and new growth fair among these transplanted seed. A second and larger transplant was made to two other areas during the last quarter of 1965.

Oyster studies programmed under special funds from the South Carolina Wildlife Commission made progress, particularly in the inventory work. Almost complete data has been gathered on the general physical environment, the quantity and quality of oysters in the Leadenwah River system. Tentative information indicates that this river system is producing about 10,000 to 15,000 bushels of oysters annually from 1,396 acres of marsh lands and 408 acres of oyster bottoms and tidal flats. With these basic data and by repeating the sampling of the oysters themselves throughout the year and throughout the years, the overall pattern of oyster conditions will become known. Considerable work of a similar nature has been carried on in the Ashepoo River system. Information extending back to 1936 for some areas in South Carolina was being sorted and assembled so that surveys of the same areas can be made now for comparison with the earlier surveys.

Pesticides: Sampling at the previously established monitoring stations continued on a monthly basis during the quarter. Fish and oyster samples from the Ashley River continued to produce DDT residuals in concentrations above the levels of samples from other areas. During November 1965, the DDT residuals of both fish and oyster samples from this area were the highest recorded so far--0.051 and 0.028 p.p.m., respectively. Dieldrin at 0.014 was recorded for the first time at the same station. As a whole, at all

stations, the residual levels of DDT and Dieldrin have been on a general increase since August 1965.

Bears Bluff Laboratories is extending its cooperative investigation on pesticides with the U. S. Bureau of Commercial Fisheries Laboratory at Gulf Breeze, Fla. Each month, fresh and quick frozen fish are shipped to Florida for analysis on the amount of Acetylcholinesterase (AChE) to determine the amount of organo-phosphate pollution.

Crab Studies: Studies on the blue crab, authorized with special funds from the South Carolina Wildlife Resources Commission, have been somewhat slow in getting underway as far as field work is concerned. The compiling and assembling of the catch per unit of effort by experimental trawls at some 20 stations from 1953 through 1965 has been completed. The purchase and assembly of the necessary gear and equipment for field work is well underway, and field work was scheduled to begin shortly after the first of the year. One set of studies to be emphasized will be to compare the catch per unit of effort by crab pots and by trawls in the vicinity of Murrells Inlet, S. C., where no commercial crabbing and no commercial trawling for shrimp or crabs takes place. Similar data will be gathered from the area in the vicinity of Price Inlet, which annually supplies one-tenth of the crab crop of the State, and where shrimp trawling is carried on offshore from June through mid-December. Data from those areas will be compared with similar information gathered in the same manner from the vicinity of Hunting Island in Beaufort County, an area which is intensely trawled for crabs and shrimp, and where commercial crabbing is carried on throughout the year. It is hoped that after at least a year's study of the kind outlined, some indication will be obtained of the effect of trawling for crabs and shrimp, and the commercial harvesting of crabs, on the crab population.

Shrimp Studies: White shrimp were about three times more abundant in experimental trawling operations during October-December 1965 as in the same quarter of the two previous years (table). Earlier in 1965, largely on the basis of data from experimental trawling and plankton tows, Bears Bluff predicted that the crop of white shrimp for 1965 would be markedly improved. Commercial landings through December show that the catch for the year was over 7 million pounds.

Cooler weather in December forced small shrimp out of the shallow waters and into the deeper areas of the river mouths and sounds. If water temperatures during the early months of 1966 do not drop too low, those shrimp should winter-over and produce a good population of roe shrimp in the spring of 1966.

The majority of the brown shrimp left inside waters comparatively early in 1965, possibly as a result of heavy competition with the very abundant white shrimp. During October through December, brown shrimp were almost nonexistent in experimental trawling operations. A few postlarval brown shrimp began to appear in plankton samples in late November and December, indicating that some spawning had already begun offshore, but no significant recruitment of those postlarvae will probably occur until February 1966.

Year	Croaker	Spot	Blue Crabs		Shrimp	
			Immature	Mature	Brown	White
1965	2.0	6.8	4.2	9.9	0.2	138.1
1964	13.7	18.5	16.2	9.5	1.4	39.8
1963	13.1	39.9	17.5	21.5	1.0	40.0

The table shows the considerable decline in abundance of croaker, spot, mature and immature blue crabs, and brown shrimp during the quarter as compared to the same period in 1963 and 1964.

Pond Cultivation: Several experimental ponds at Bears Bluff Laboratories were drained and harvested during October 1965. Results were good. In one experiment, a one-acre pond, which had been stocked during May-August 1965 with postlarval and juvenile white and brown shrimp, yielded about 220 pounds of shrimp when drained on October 15. The pond had been stocked heavily with over 8,000 shrimp which were fed about 600 pounds of chopped fish, crab, and commercial fish food during the culture period. Mortality was low in this experiment, particularly among the white shrimp, and about 14,500 (80 percent of those stocked) were harvested when the pond was drained. The pond was treated with rotenone twice to remove fish; crab pots were used to control crabs.

The size of the shrimp harvested were small, indicating that under the existing conditions of food and living space, stocking had been too heavy for maximum growth to take place.

A small one-tenth acre pond was drained on October 22, 1965, and a harvest which was equivalent to 250 pounds per acre was obtained. The pond had been stocked with 1,200 juvenile white shrimp in June and July. In June the pond had been previously drained and harvested for brown shrimp stocked earlier in the year. The total yield for the year for both species was equivalent to about 325 pounds to the acre.

Experiments testing the effects of superphosphate fertilizer on shrimp pond production were begun in December 1965, using several heated concrete tanks and a one-acre pond as well. It is well known that added phosphate can greatly increase productivity in fresh-water fish ponds, but little is known about the effects of such fertilizers in salt-water impoundments.

Note: See Commercial Fisheries Review, September 1965 p. 44.



U. S. Foreign Trade

AIRBORNE IMPORTS OF FISHERY PRODUCTS, JANUARY-SEPTEMBER 1965:

Shrimp from Venezuela continued to be the main airborne fishery import into the

Product and Origin 2/	July-Sept. 1965		Jan.-Sept. 1965		Jan.-Sept. 1964	
	Qty. 3/	Value 4/	Qty. 3/	Value 4/	Qty. 3/	Value 4/
	1,000 Lbs.	US\$ 1,000	1,000 Lbs.	US\$ 1,000	1,000 Lbs.	US\$ 1,000
Fish:						
All countries . . .	181.0	171.0	662.7	651.2	356.4	104.1
Shrimp:						
Venezuela	1,112.9	592.1	8,831.2	4,518.6	4,671.2	2,202.4
Panama	223.0	161.6	815.4	532.5	812.8	499.1
Costa Rica	-	-	104.8	50.2	296.1	161.2
El Salvador	-	-	28.1	19.1	159.1	96.8
Other countries . . .	1.2	1.4	55.7	31.8	114.6	61.2
Total shrimp . . .	1,337.1	755.1	9,835.2	5,152.2	6,053.8	3,020.7
Shellfish other than shrimp:						
Canada	1.6	0.5	25.5	9.2	312.9	173.4
Mexico	7.5	8.9	8.7	9.9	14.4	9.9
British Honduras . .	94.9	125.4	171.1	182.9	207.3	165.5
Honduras	9.2	11.0	24.8	16.7	72.9	78.7
Nicaragua	5.4	3.0	109.5	115.0	50.5	40.0
Costa Rica	-	-	13.9	13.3	18.6	14.2
Jamaica	27.9	23.7	53.7	59.4	52.9	49.6
Other countries . . .	37.5	42.5	146.7	119.7	54.5	24.4
Total shellfish (except shrimp)	184.0	215.0	553.9	526.1	784.0	555.7
Grand total	1,702.1	1,141.1	11,051.8	6,329.5	7,194.2	3,680.5

1/Imports into Puerto Rico from foreign countries are considered to be United States imports and are included. But United States trade with Puerto Rico and with United States possessions and trade between United States possessions are not included.
 2/When the country of origin is not known, the country of shipment is shown.
 3/Gross weight of shipments, including the weight of containers, wrappings, crates, and moisture content.
 4/F.o.b. point of shipment. Does not include U.S. import duties, air freight, or insurance.
 Note: These data are included in the overall import figures for total imports, i.e., these imports are not to be added to other import data published.
 Source: United States Exports & Imports by Air, FT 785, January through September 1965, U.S. Bureau of the Census.

United States during the third quarter of 1965. In January-September 1965, airborne imports of fishery products into the United States totaled 11.1 million pounds with a value of \$6.3 million. Airborne fishery imports increased 53.6 percent in January-September 1965 as compared with the same period in 1964 when smaller quantities of shrimp were shipped by air from Venezuela.

The data as issued do not show the state of all products--fresh, frozen, or canned--but it is believed that the bulk of the airborne imports consisted of fresh and frozen products.

* * * * *

IMPORTS OF CANNED TUNA UNDER QUOTA:

United States imports of tuna canned in brine during January 1-December 31, 1965, amounted to 49,203,807 pounds (about 2,343,038 standard cases), according to preliminary data compiled by the U. S. Bureau of Customs. That was a decrease of 7.0 percent from the 52,930,989 pounds (about 2,520,523 standard cases) imported during January 1-December 31, 1964.

The quantity of tuna canned in brine which could be imported into the United States during the calendar year 1965 at the 12½-percent rate of duty was limited to 66,059,400 pounds (or about 3,145,685 standard cases of 48 7-oz. cans). Any imports in excess of that quota would have been dutiable at 25 percent ad valorem.



Virginia

MARINE SCIENCE SUMMER TRAINING PROGRAM FOR HIGH SCHOOL STUDENTS:

The National Science Foundation has granted \$8,500 to the Virginia Institute of Marine Science, Gloucester Point, Va., to operate a special class in marine science at a Norfolk, Va., High School during the summer of 1966.

The Institute has cooperated with the Norfolk school officials for the past four summers in presenting special courses in marine science to challenge exceptional secondary school students to higher achievement scholastically and to introduce them to the fascinating study of marine environment.

During those years 60 students and 10 high school teachers have participated in lectures, laboratory studies, and field work. They have studied ecological areas at ocean beaches, Eastern Shore, Gloucester Point, and other localities in tidewater Virginia. The program in marine science will be expanded this summer to accommodate 30 students rather than the 15 enrolled in previous summers. Five students are selected each year from other schools in Continental United States.

The outstanding feature of this program is the special ecological study conducted by students and teachers in the field. About two days each week are spent visiting various marine habitats and studying the marine plants and animals associated with them.

The program is to encourage capable young people to consider the possibilities of a career in marine science.

Note: See *Commercial Fisheries Review*, March 1965 p. 57, February 1965 p. 45.



Washington

EVALUATION OF COST AND PRODUCTION OF FISH FARMS:

An evaluation of the cost and production of each fish farm operated by the Department of Fisheries has been completed. The evaluation enables the Department to judge the worth of the fish farms in terms of salmon produced compared to the cost of construction, maintenance and operations.

Fish farms which have been found to be the best producers are being turned over to the Hatchery Division for operation.

Several areas will be retained by the Research and Management Division. In those ponds, experiments will be continued aimed at increasing the production and survival of fish-farm salmon. Techniques enabling high production of good quality young salmon in fish farms at a reasonable cost have yet to be found. Until better methods are devised, the main emphasis in artificial rearing will be the present hatchery system.

Several fish farms now considered borderline may prove valuable in future years. These will be deactivated and held in reserve.

Anderson Lake, Heines Lake, and Maylor Lagoon will be abandoned. Black Lake may be abandoned or planted only every other year due to residentialism of young silver salmon at that lake.

The change in program and lack of funds makes it necessary to eliminate four positions in the Research and Management Division. The permanent fish farm staff of 3 biologists and 3 hatchery men will be reduced to 2 biologists. (Washington Department of Fisheries, January 19, 1966.)

See Commercial Fisheries Review, October 1965 p. 58.



Weather

NEW RADIO BROADCAST NETWORK ESTABLISHED FOR MARINERS:

A network of 15 additional VHF radio stations, operating on a frequency of 162.55 megacycles, will be established by the Environmental Science Services Administration (ESSA), U. S. Department of Commerce, to provide mariners with continuous FM transmission of weather warnings, forecasts, and reports. The new radio stations will operate from ESSA's Weather Bureau offices along the Atlantic and Gulf coasts.

The stations, slated to be in operation before the start of the 1966 hurricane season next June, will be located at the ESSA Weather Bureau sites at Miami, Fla., Boston, Mass., Washington, D. C., Norfolk, Va., Atlantic City, N. J., Jacksonville, Fla., Charleston, S. C., Providence, R. I., Wilmington, N. C., New Orleans, La., Tampa, Fla., Lake Charles, La., and Brownsville, Galveston, and Corpus Christi, Tex. The Weather Bureau already operates continuous VHF broadcast stations in New York City, Chicago, and Kansas City.

Any craft carrying a suitable FM radio receiver within an approximate 40-mile radius of those cities will be able to receive the latest weather forecasts, warnings, and coastal station reports.

Weather bulletins will be prepared by Weather Bureau personnel and tape recorded. An automatic device will then replay the tape over the air. The taped message will be updated every three hours or more frequently during rapidly changing weather situations.

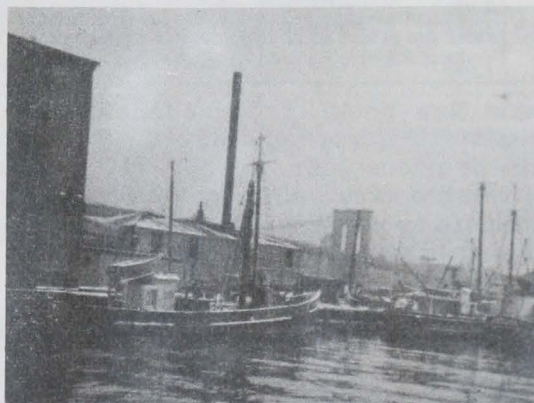
ESSA is a new agency of the U. S. Department of Commerce established in July 1965 to serve as a focus for national efforts to describe, understand, and predict man's natural environment. It includes the Weather Bureau, the Coast and Geodetic Survey, and the former Central Radio Propagation Laboratory of the National Bureau of Standards.



Wholesale Prices

EDIBLE FISH AND SHELLFISH, JANUARY 1966:

The January 1966 wholesale price index for edible fish and shellfish (fresh, frozen, and canned) at 124.5 percent of the 1957-58 average was up 4.4 percent from the previous month and 11.1 percent from the same month in 1965. The increase from December was due primarily to much higher fresh haddock prices at Boston caused by the short supply. In January this year, prices for most of the fishery products that make up the wholesale price index were higher than in the same month in 1965.



Draggers unloading at docks of New York City's Fulton Fish Market, Jan. 1966. (Brooklyn Bridge in background.)

January 1966 prices in the drawn, dressed, or whole finfish subgroup were unchanged from December 1965 for western halibut and salmon at New York City and whitefish at Chicago. There was a 5.6-percent increase in fresh yellow pike prices at New York and a 60-percent increase in large fresh haddock at Boston. The index for all items in this subgroup was much higher than a year ago.

Fresh processed fish and shellfish prices were at the same level as December except for an increase of 8.8 percent in fresh shrimp

Wholesale Average Prices and Indexes for Edible Fish and Shellfish, January 1966 with Comparisons								
Group, Subgroup, and Item Specification	Point of Pricing	Unit	Avg. Prices 1/ (\$)		Indexes (1957-59=100)			
			Jan. 1966	Dec. 1965	Jan. 1966	Dec. 1965	Nov. 1965	Jan. 1965
ALL FISH & SHELLFISH (Fresh, Frozen, & Canned)					124.5	119.3	119.4	112.1
<u>Fresh & Frozen Fishery Products:</u>					127.7	120.6	122.7	118.3
<u>Drawn, Dressed, or Whole Finfish:</u>					138.3	123.4	128.5	121.8
Haddock, lge., offshore, drawn, fresh.	Boston	lb.	.24	.15	187.4	119.6	143.4	133.3
Halibut, West., 20/80 lbs., drsd., fresh or froz.	New York	lb.	.48	.48	141.0	141.0	140.5	118.3
Salmon, king, lge. & med., drsd., fresh or froz.	New York	lb.	.88	.88	122.3	122.3	122.3	119.1
Whitefish, L. Superior, drawn, fresh	Chicago	lb.	.63	.63	93.3	93.3	85.8	90.3
Yellow pike, L. Michigan & Huron, rnd., fresh	New York	lb.	.75	.71	122.8	116.2	126.9	122.8
<u>Processed, Fresh (Fish & Shellfish):</u>					128.3	123.5	124.2	116.0
Fillets, haddock, sml., skins on, 20-lb. tins	Boston	lb.	.44	.44	105.7	105.7	115.4	134.8
Shrimp, lge. (26-30 count), headless, fresh	New York	lb.	.99	.91	116.0	106.6	106.6	109.6
Oysters, shucked, standards.	Norfolk	gal.	8.75	8.75	147.6	147.6	147.6	120.1
<u>Processed, Frozen (Fish & Shellfish):</u>					111.9	110.6	110.9	111.8
Fillets: Flounder, skinless, 1-lb. pkg.	Boston	lb.	.40	.40	101.4	101.4	103.9	92.5
Haddock, sml., skins on, 1-lb. pkg.	Boston	lb.	.40	.40	115.8	115.8	117.3	115.8
Ocean perch, lge., skins on 1-lb. pkg.	Boston	lb.	.32	.32	112.2	112.2	112.2	106.9
Shrimp, lge. (26-30 count), brown, 5-lb. pkg.	Chicago	lb.	.93	.91	110.3	107.9	107.3	112.1
<u>Canned Fishery Products:</u>					119.3	117.5	114.0	101.8
Salmon, pink, No. 1 tall (16 oz.), 48 cans/cs.	Seattle	cs.	28.00	27.50	122.0	119.8	117.7	91.5
Tuna, lt. meat, chunk, No. 1/2 tuna (6-1/2 oz.), 48 cans/cs.	Los Angeles	cs.	12.50	12.25	111.0	108.8	102.6	102.6
Mackerel, jack, Calif., No.1 tall (15 oz.), 48 cans/cs.	Los Angeles	cs.	7.13	7.13	120.9	120.9	120.9	105.9
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	128.3

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.

prices at New York. Haddock fillets and shucked oysters were unchanged. Compared with the previous year, the January 1966 index of fresh processed items was higher for all products except small haddock fillets which were down 21.6 percent.

Frozen fillet prices in January 1966 were at the same level as the previous month and generally higher than in January 1965. The subgroup index for frozen processed fish and fillets was up slightly from December due to a small increase in large shrimp prices at Chicago. Compared with January 1965, the

current index was up very slightly but there was a mixed trend in the individual items.

The January 1966 subgroup index for canned fishery products rose 1.5 percent from the previous month. Prices for canned pink salmon and canned lightmeat tuna continued to climb while canned Maine sardines and California jack mackerel were unchanged. Prices for all items in this subgroup were much higher than a year ago and the index was up 17.2 percent. Stocks of canned pink salmon continued light, while the canned tuna market has tightened considerably.



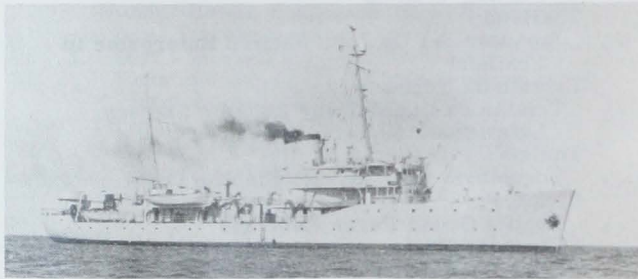
UNDERSEA MOUNTAINS DISCOVERED IN PACIFIC

The discovery of 12 undersea mountains north of the Hawaiian Islands, several of them towering almost 2.5 miles above the ocean floor, was reported May 21, 1965, by the Coast and Geodetic Survey, U. S. Department of Commerce. The massive elevations in the sea floor, termed seamounts by oceanographers, were covered by almost 1 to 2.5 miles of water.

The seamounts are probably of volcanic origin. They were located by C&GS ocean survey vessels in an area dotted with undersea mountains, between 250 and 1,000 miles north of the Hawaiian Islands.

One seamount, discovered by the vessel Surveyor, had a base which covered 18 miles in a North-South direction, with a crater 2 miles across and 900 feet deep. The crater's depth was considered unusual, because undersea mountain craters usually fill up. An oceanographer said this indicated the mountain was "comparatively young," geologically speaking. The seamount was 9,400 feet high, slightly less than the 9,700-foot mountain reported nearby earlier by the Surveyor.

The remaining seamounts were discovered by the vessel Pioneer. One rose 13,100 feet above the sea bottom, almost as high as Mt. Kennedy, the Canadian peak named for the late President. The seamount was discovered in an area where the ocean is more than 3.5 miles deep. The peak was covered by almost a mile of water.



The Pathfinder, one of the larger ocean survey vessels.

Another seamount reported by the Pioneer was almost as tall, 12,720 feet; 4 were about 2 miles high, and the balance ranged from one-half mile to one and a half miles in height.

The seamounts were discovered while the Pioneer and Surveyor were exploring the ocean's depths between the Hawaiian and Aleutian Islands. The Pathfinder, operating in the same general area, also reported discovery of an undersea mountain of undetermined height, its peak covered by 750 feet of water.

Announcement of the discoveries was made after the C&GS vessels returned to their West Coast bases and the data concerning the seamounts could be fully analyzed.

Seamounts have a practical significance for submarine and surface ships. They provide vessels, many of which are equipped with echo-sounders, with important undersea landmarks.

Many seamounts are given names by the Board on Geographic Names and their location noted on nautical charts. An undersea elevation is generally regarded as a seamount if it is at least 3,000 feet high and less than 60 miles across the top. Aside from seamounts, the ocean floor is also filled with giant mountain ranges and plateaus. (Coast and Geodetic Survey, U. S. Department of Commerce, Washington, D. C., May 21, 1965.)