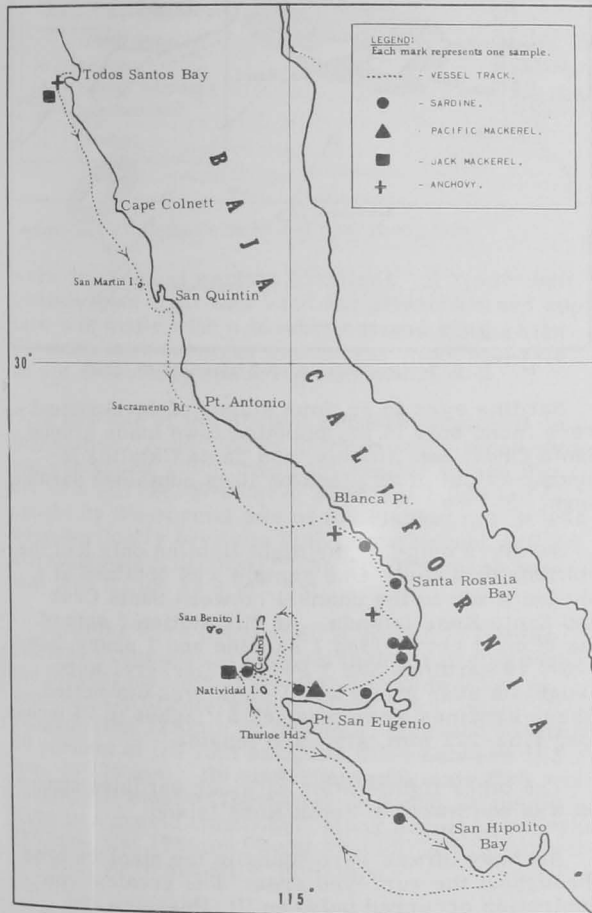


TRENDS AND DEVELOPMENTS

California

SPAWNING SARDINES SURVEYED OFF COAST OF CALIFORNIA (M/V N. B. Scofield): Cruise 58-S-1, February 21-28, 1958: The coastal waters



M/V N. B. Scofield) Cruise 58-S-1, February 21-28, 1958.

from one-half to 30 miles offshore of Baja California from Ensenada to Ballenas Bay were surveyed by the California Department of Fish and Game research vessel N. B. Scofield to locate and sample spawning populations of sardines for age composition and subpopulation studies. This cruise, the first of its type and exploratory in nature, was planned to develop techniques and methods of effective sampling of spawning sardines.

Other objectives included: (1) collection of live sardines for genetic subpopulation studies by the U. S. Bureau of Commercial Fisheries; (2) collecting blood serum from yellowtail and bonito to be used in genetic studies on sardines; (3) experimentation with different colored lights for attract-

ing fish; and (4) collection of specimens as requested by other departmental investigations.

Fishing stations were made at night on visually-located schools and in previously productive bays. Stations were also occupied where plankton tows yielded sardine eggs and larvae. A 1,500-watt light was used for attracting the fish and a blanket net or snag gangs were used for sampling.

A total of 55 fishing stations was occupied and sardines were taken at 9, northern anchovies at 3, Pacific mackerel at 2, and jack mackerel at 2. All fish taken except 2 samples of anchovies were caught within 5 miles of shore. Most of the sardine samples were taken in Sebastian Viscaïno Bay.

In the 803 miles scouted on the cruise, 28 schools of pelagic fish were observed; 26 were identified as sardines and 2 were unidentified. Most of the sardine schools were sighted in the vicinity of Cedros Island and several at Soledad and Ballenas Bays. California gray whales were observed frequently during the cruise. The greatest numbers were observed near Scammon Lagoon and Asuncion Island.

No ripe-running sardines were taken, but a large percentage were in a gravid condition. The largest sardines taken were from Sebastian Viscaïno Bay. Plankton tows produced sardine eggs and larvae in 9 of 14 tows. Anchovy eggs were present in large numbers at several locations in Sebastian Viscaïno Bay.

Observations on the behavior of sardines and their reaction to types of gear were made as a basis for developing an effective sampling tool.

Although offshore plankton tows yielded sardine eggs and larvae, no fish were observed or caught. The larger sardines caught inshore were feeding vigorously on the surface and were captured easily with snag gangs and blanket net. The smaller fish stayed deep and could be caught only with much difficulty in the blanket net. Sardines were taken in 9 of 13 locations where sampling was attempted. Visually-located schools either ignored the attracting light or remained at such a distance as to make capture improbable.

Offshore operations were greatly hampered with all types of gear available due to weather conditions. Blanket-net sets offshore were made difficult because of roll and drift of the vessel.

Limited experiments with colored lights were conducted. Green and blue lights were used simultaneously with a standard 1,500-watt white

light. Observations were made on the degree of attraction and behavior of fish under each light. Colored lights were used both above and below water. In the experiments conducted, the white light apparently was much superior in attracting fish. There was some evidence that the green light was slightly superior in attracting larval fish.

Surface water temperatures ranged from 14.9° C. (58.8° F.) at Cape Colnett to 20.0° C. (68.0° F.) off Asuncion Bay. Bathythermograph casts indicated subsurface waters varying but little from surface temperatures to a depth of nearly 200 feet.

Cruise 58-S-2, March 12-28, 1958: The second in this series of cruises was made in the coastal waters from San Pedro to Point Buchon and the waters around Santa Catalina, San Clemente, Santa Cruz, Santa Rosa, and San Miguel Islands. The objectives were: (1) to locate and sample spawning sardines in order to determine their age and length composition, and to attempt to distinguish between sardines spawning in different areas or at different times; (2) to collect live sardines for genetic studies by the U. S. Bureau of Commercial Fisheries; and (3) to observe the behavior of spawning sardines in order to develop more efficient sampling techniques.

Two methods were used in locating fish: (1) a light station; and (2) visual scouting while under way. The methods were used alternately beginning with a light station at the anchorage of the previous day.

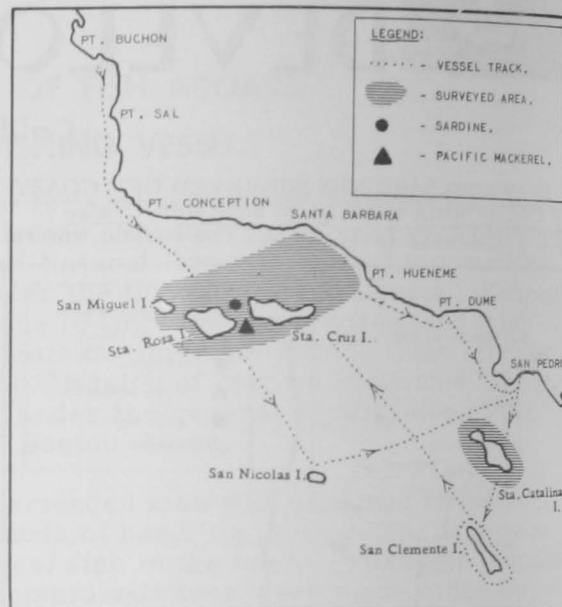
At each light station: (1) A 10-minute oblique plankton tow was made with a standard 1-meter plankton net from a depth of 20 meters to the surface. (2) After the plankton tow was completed, the vessel was allowed to drift and a 1,500-watt incandescent light was suspended above the surface of the water for a period of time--up to one hour. (3) While the light was turned on, the surface water temperature and the water temperature at 10 meters was measured; a bathythermograph was made; and the plankton sample was examined for the occurrence of sardine eggs and larvae. (4) If fish appeared under the light, attempts were made to catch them with blanket net, snag gangs, baitless lures, or dip nets.

Visual scouting consisted of observing fish schools while the vessel was under way or by detecting schools with the recording echo-sounder. When a school of fish was sighted or detected on the echo-sounder, the vessel was stopped and a light station was made.

Locating and sampling spawning groups of sardines was severely hampered by a series of storms which occurred throughout the survey period. Most

of the work was accomplished during calm periods between the storms.

Scattered and isolated schools of fish were observed between Pt. Buchon and San Pedro. Schools were more numerous between Pt. Sal and Pt. Arguello and around the Channel Islands.



M/V N. B. Scofield Cruise 58-S-2 (March 12-28, 1958).

Sardine eggs in various stages of development were found only in the plankton tows made around Santa Cruz, San Nicolas, and Santa Catalina Islands--27 out of 50 plankton tows contained sardine eggs.

Sardines came to the night light on only 2 of the stations occupied. One sample was obtained at a station made in the channel between Santa Cruz and Santa Rosa Islands. At this station 3 sets of the blanket net yielded 1 sardine and 1 saury; however, 16 sardines and 1 Pacific mackerel were caught on snag gangs and 1 squid was dip-netted. These sardines were between 6½ inches to 9½ inches long (158-222 mm. standard length).

The other light station at which sardines appeared was southwest of Santa Rosa Island.

Anchovy larvae were found in the plankton tows throughout the surveyed area. The greatest concentration occurred between Pt. Hueneme and Santa Barbara.

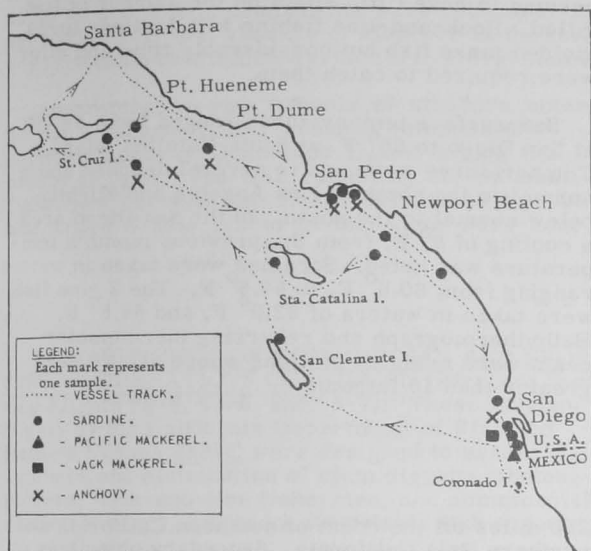
The sea surface temperatures ranged from 13.1° C. to 15.5° C. (55.6° F. to 59.9° F.).

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SPAWNING SARDINES SURVEYED IN SOUTHERN CALIFORNIA WATERS BY M/V ALASKA: Cruise 58-A-1, April 12-30, 1958: The first of a series of cruises was made by the California Department of Fish and Game research vessel Alaska off the coast and islands of southern California from Santa Barbara to the Coronado Islands. The objectives were: locate and sample spawning

sardines in southern California waters as a part of age composition and subpopulation studies; (2) develop methods of capturing spawning sardines; (3) collect live sardines for genetic subpopulation studies by the U. S. Bureau of Commercial Fisheries; and (4) collect specimens as requested by other departmental investigations.

Fishing stations were occupied in areas where fish were observed visually or detected by echo-sounding or echo-ranging devices. Other stations



M/V Alaska Cruise 58-A-1 April 12-30, 1958

were occupied at certain locations. A 1,500-watt incandescent light was used for attraction and capture was made with a blanket net and snag gangs. Plankton tows for eggs and larvae were made as an aid in locating spawning fish.

A new use of the blanket net was employed on this cruise. A section of black $1\frac{1}{4}$ -inch mesh webbing was added which made it possible to use the net as a gill net. Whenever sardines could not be caught by the normal use of the blanket net, it was hung vertically over the side of the vessel and the attracting light dimmed. The $1\frac{1}{4}$ -inch mesh section thus fished as a gill net.

Sardines were present at 18 of the 72 fishing stations occupied and were captured at 16 stations--the largest number of sardine samples taken in southern California waters since 1951. Sizes ranged from 129 mm. to 244 mm. standard length--80 percent of the fish sampled were between 145 mm. to 175 mm. No ripe-running female fish were caught, but most of them over 175 mm. in length were in a gravid condition. Many sardines between 145 mm. and 175 mm. were gravid. All fish under 145 mm. were sexually immature.

In the 381 miles scouted, 38 sardine-schools were observed. All but 6 were small--less than 3 tons. The small schools were most numerous from Huntington Beach to San Mateo Point and offshore to Lasuen Seamount. The 6 large schools were observed near Santa Cruz Island.

In addition to sardines, 26 schools of sauries, 55 of anchovies, and 26 unidentified schools were observed; and 6 samples of anchovies, 1 of jack mackerel, and 1 of Pacific mackerel were collected.

The blanket net with the modification for use as a gill net operated with encouraging results. Although only a few full 50-fish samples were taken, there were only two occasions when the net failed

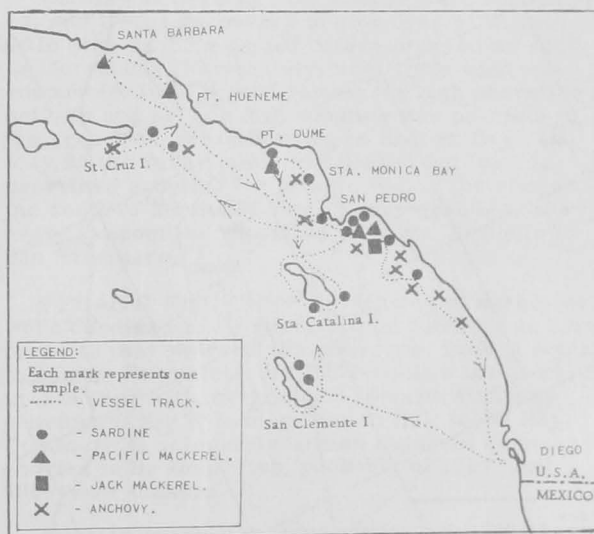
to catch fish when sardines were present beneath the attracting light.

Due to adverse weather conditions, investigation was curtailed in the Santa Cruz Basin and the Tanner-Cortez Bank area. Surface water temperatures ranged from a high of 68° F. at San Diego to a low of 51.8° F. at Santa Rosa Island.

Cruise 58-A-2, May 12-28, 1958: The second of this series of cruises was made off the coast and islands of Southern California from Santa Barbara to San Diego. The objectives were: (1) to locate and sample spawning sardines in order to determine their age and length composition, and to attempt to distinguish between sardines spawning in different areas or at different times. (2) to continue gear experimentation in an attempt to increase sampling efficiency; and (3) to collect specimens of barracuda and white sea bass wherever possible.

Of 71 light stations occupied, sardines were taken at 14, northern anchovies at 10, Pacific mackerel at 5, and jack mackerel at 1.

Two gravid female sardines containing free transparent eggs were taken at different locations at Santa Catalina Island. (Less than 40 California sardines have been observed in this condition.) These fish measured 181 mm. and 214 mm. The remainder of the samples consisted largely of males. The behavior of the schools containing the ripe fish was typical of many others attracted to the light. The schools were small--less than 1 ton--with the fish occasionally darting to and from the surface.



M/V Alaska Cruise 58-A-2 May 12-28, 1958

The Alaska scouted 372 miles during which 58 sardine schools were sighted. All but three were observed in the vicinity of Anacapa Island. A plankton tow through a school group in this area failed to produce evidence of spawning. Other pelagic fish school sightings included 6 anchovies, 4 Pacific mackerel, 2 saury, and 16 large unidentified tunalike fish.

The sardine samples consisted predominately of 2 distinct size groups with modes at 170 mm. and 200 mm. Nearly all females in the large size group were in an advanced stage of sexual maturity. The smaller group contained nearly all stages, ranging from immaturity to highly gravid.

Difficulty was experienced in attracting and capturing sardines. The fish were attracted with a 1,500-watt incandescent lamp and caught with snag gangs, baitless lures, and by gilling in the blanket net. Of the 100 fish collected, 43 were gilled in the blanket net, 36 were caught with hook and line and 21 with the blanket net. With one exception, schools sighted visually did not come to the light.

The blanket net did not operate effectively because most of the schools sounded immediately when the net was placed in the water. The best results were obtained by using it as a gill net. When

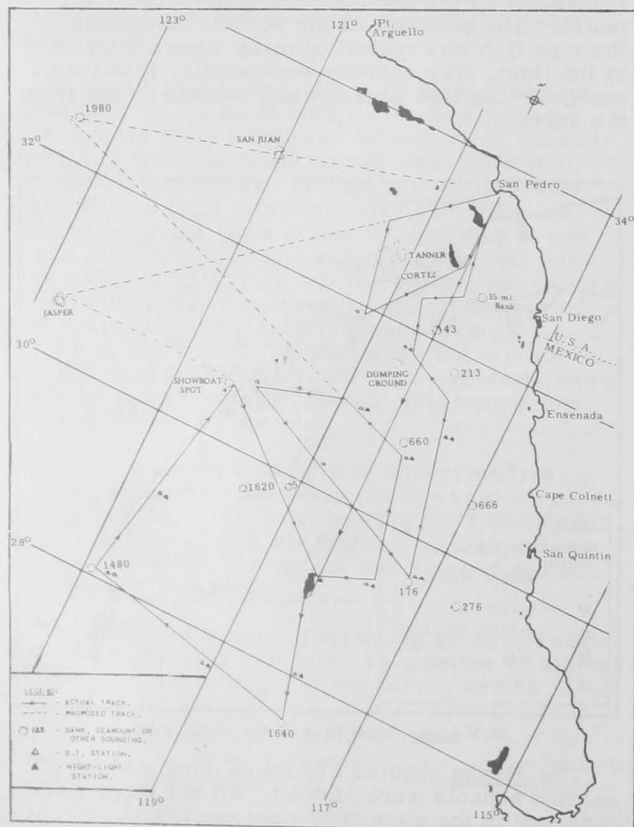
fish appeared under the light, the net was placed in the water and allowed to remain until fish gilled in the large webbing. Varying the light intensity seemed to have little effect on the number of fish gilled. Hook-and-line fishing with baitless lures yielded more fish but considerable time and effort were required to catch them.

Sea-surface temperatures ranged from 58° F. at San Diego to 66° F. at Santa Catalina Island. Temperatures were one to several degrees above normal to the north of Los Angeles and slightly below normal to the south. In the San Diego area a cooling of 8° F. from the previous month's temperature was noted. Sardines were taken in waters ranging from 60.6° F. to 64.6° F. The 2 pipe fish were taken in waters of 62.0° F. and 64.6° F. Bathythermograph and reversing thermometer casts were made on stations where depths were greater than 10 fathoms.

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ALBACORE TUNA OCCURRENCE AND MIGRATION PATTERN STUDIED (M/V Alaska Cruise 58A3 - Albacore): An exploratory survey prior to the commercial albacore fishing season was conducted by the M/V Alaska of the California Department of Fish and Game in an attempt to determine

250 miles off the coast of southern California and northern Baja California. Secondary objectives of the cruise were to tag and release albacore, and to gather pertinent biological and oceanographic data, which might be related to the occurrence of albacore.



M/V Alaska Cruise 58A3 - Albacore (June 9 to 29, 1958).

the occurrence and migration pattern of albacore schools as they approach the Pacific Coast. The cruise commenced on June 9 and ended on June 29 when the vessel returned to Los Angeles Harbor. The area survey covered the waters that lie 80 to

approximately 1,700 nautical miles in the nearly 63,000-square-mile survey area were scouted during daylight hours using surface trolling gear. No incoming schools of albacore were located during the course of the survey, although commercial fishermen working inshore from the survey area, within 60 miles of the mainland shore were catching a few large (20- to 40-pound) fish.

Three attempts were made to scout areas farther north and west, i. e. San Juan Seamount to 123° W. longitude. Each time, inclement northwesterly weather conditions made visiting these areas imprudent. Commercial boats, from northern ports, heading for southern California were reported to be catching a few smaller (10- to 15-pound) fish shoreward of this proposed scouting area.

No tagging was accomplished on this cruise as no incoming schools of albacore were located.

Sea surface temperatures were observed and recorded at intervals of 15 to 60 minutes during daylight hours and continually graphed by recording thermometer. Warmest temperatures (up to 70° F.) were encountered in the southwest portion of the survey area; coolest temperatures (down to 62.6° F.) in the northern area from about Sixty-mile Bank toward Cortez Bank and San Clemente Island. Dirty green water characterized the cool surface temperatures to the north while clear, blue water prevailed over the remainder of the area surveyed.

Bathythermograph casts were made at the end of each day's run and additional casts were made when conditions warranted. Cursor examination of the resulting slides indicated deepest thermoclines south and east of Guadalupe Island. The shallowest thermoclines were found at the more northerly stations; while the most distinct (sharpest) were at those stations farthest offshore.

A night light station, using a 1,500-watt bulb, was occupied each night that drifting conditions permitted. At nearly every light station, many of the usual albacore food components were collected. It seems unlikely that absence of albacore in the survey area could be attributed to lack of food organisms.

Apparently, no new schools of albacore entered the southern fishing grounds immediately north or south of Guadalupe Island during the month of June. The fish caught by commercial fishermen between San Benito Islands on the south and Todos Santos Island to the north were con-

sidered to be numbers of a small, "holdover" population from the preceding season.

The only indication of new schools of albacore moving into range of the California fleet comes from boats traveling to southern California from northern ports. Several of these fishermen caught scattered small fish north of Point Conception while running on a direct course.

It appears that this year's run of albacore will occur at latitudes farther to the north than has been characteristic of at least the past eight years.

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AERIAL CENSUS OF COMMERCIAL AND SPORT FISHING OPERATIONS CONTINUED (Airplane Spotting Flights 58-4, 58-6, and 58-7): These airplane flights by the California Department of Fish and Game's Cessna 3632C were designed to assess the numbers and distribution of clam diggers, abalone pickers, hook-and-line fishermen, and commercial salmon trollers, and to locate pelagic fish schools.

Flight 58-4 (May 8-9, 1958): The inshore area between Pt. Sur, Monterey County, and the Russian River, including San Francisco, Bodega, Bolinas, and Tomales Bays was surveyed in the third of a series of flights.

Fog prevented scouting for pelagic fish on both days of this flight. The area from the Russian River to Fort Bragg could not be scouted because of fog and commercial salmon trollers could not be sighted farther offshore than about 4 miles. The fog, however, was not too low to prevent a survey of shoreline activity. A -0.8 tide on May 8 attracted abalone pickers to the rocky areas but the -0.2 low tide on May 9 was evidently not low enough for good abalone picking.

ABALONE PICKERS: On May 8 a total of 35 abalone pickers were sighted in the area between Pt. Sur and the Russian River; of these, 19 were observed near Pigeon Point, San Mateo County. On May 9, only 2 abalone pickers were observed--1 was a skin diver off Tomales Point.

CLAMMERS: The Pismo clam season closed on May 1, 1958, in Monterey Bay, and the only clammers sighted were those digging for mud clams in the bays and for cockles and little neck clams at Bolinas and Sharps Park.

Bay clammers were sighted on each day but in fewer numbers than on previous flights this year, despite the good low tide on May 8.

HOOK-AND-LINE FISHERMEN: Hook-and-line fishermen were comparable in numbers to that of previous flights this year with the largest concentration of shore fishermen at Baker's Beach and the largest number of pier fishermen at Berkeley Pier. In addition to the pier and shore fishermen, 24 skiffs were sighted on May 8--20 of these were in Monterey Bay where salmon were being caught. Due to limited visibility no skiffs were counted on May 9 in Monterey Bay.

SALMON TROLLERS: On May 8, 37 commercial salmon trollers were tallied in Monterey Bay

but limited visibility prevented sighting of commercial trollers to the north of Monterey Bay. (On Saturday, May 10, 14 commercial trollers off Pt. Reyes and 71 trollers between Bodega Bay and Fort Bragg were sighted from a commercial airline.)

PELAGIC FISH CENSUS: Pelagic fish schools could not be sighted because of the fog. Some scouting was attempted off San Francisco and in Monterey Bay but excessive glare on the water and fog patches close to the ground made scouting impractical.

Flight 58-6 (May 22-23, 1958): The inshore area between Pt. Arguello and Bodega Bay, including Bodega, Bolinas, Drakes, and Tomales Bays was surveyed during the fourth of this series of flights.

On May 22 several rain squalls were encountered, and it was necessary to stop over at Watsonville airport for a period before proceeding south to Morro Bay. Fortunately, very little wind was encountered and a good survey for both shoreline activity and pelagic fish scouting was possible in the area from Moss Landing to Bodega Bay. On May 23 the rain squalls had passed but low fog prevented scouting for pelagic fish in the area to the south of Monterey Bay. It was possible, however, to scout the shoreline from Pt. Arguello to San Francisco.

PELAGIC FISH CENSUS: Schools of anchovies were observed in relatively large numbers as compared to past years in the area from Bodega south to Pigeon Pt. A total of 1,078 schools was observed in this area with the greatest concentrations appearing off San Francisco and in Half Moon Bay. Commercial salmon fishermen reported these anchovies to be small fish, probably of 1957- and 1958-year classes.

COMMERCIAL SALMON TROLLERS: A total of 134 trollers was sighted in the area between Moss Landing and Bodega Bay; of these, 127 were operating in the area from Drakes Bay to Bodega Bay.

CLAMMERS AND ABALONE PICKERS: A total of 21 bay clammers and 6 ocean clammers were tallied between Moss Landing and Bodega Bay. (The Pismo clam season closed on May 1 in Monterey Bay; hence, no tallies of Pismo clammers were expected to be made until the season reopened on September 1.) The ocean (outer beach) clammers

were sighted near Bolinas and San Francisco, and the bay clammers were sighted in Bodega, Tomales, and Drakes Bays.

HOOK-AND-LINE FISHERMEN: The beaches around San Francisco and Sharps Park continued to be the most favored surf-casting areas in Central California. About half of all the surf casters tallied on each day's flight were sighted in this area. The numbers of both surf and rock fishermen were very much the same as tallied previously.

Flight 58-7 (May 26-27, 1958): The inshore area between Monterey and Trinidad Head was surveyed on this flight, and excellent flying conditions prevailed on both days, making it possible to cover over 350 miles of coastline. The tide was not low enough for clammers and abalone pickers. Both pelagic fish and salmon trollers were scouted while flying one way along the coast and on return trips shore fishing activity was noted by flying at low altitude over the shoreline.

PELAGIC FISH: Large numbers of anchovy schools (over 4,500) were sighted on this flight. This represents more anchovy schools than have been seen on any flight made over the past four years in both California and Baja California waters. All the school groups encountered on this flight were a mixture of very small- to medium-size schools with a few large schools. The average fish school probably contained around 15-20 tons of fish.

The tally of these schools was made on the return trip from Trinidad Head south to Palo Alto and time did not permit intensive survey of each school group. Instead, one straight-line flight was made over each school group area, and all the schools visible on both sides of the plane were counted. Thus, schools passing directly under the plane and those beyond the visibility zone were not counted

and the numbers of schools given--especially those for the school group of Tomales Point to Point Reyes--are less than the actual number present at the surface.

Anchovy schools were also sighted in Monterey Bay during this flight. Future flights, however, will give a more representative estimate of the amount of fish present in this region of the coast because the water is still quite rich in phytoplankton which prevents sighting of fish schools unless they are very near the surface. Over the past four years fish schools have appeared at the surface in greater numbers from late June through November in Monterey Bay. Commercial fishermen and party-boat operators have reported large numbers of 5-inch anchovies in Monterey Bay, indicating most of the fish in this area are of the 1957-year class. Several sardines ranging from 135-161 mm. standard length were picked out of a haul of anchovies taken in Monterey Bay, but no pure schools of sardines were seen from the air or were reported by fishermen.

COMMERCIAL SALMON TROLLERS: The main concentrations of salmon trollers were adjacent to and sometimes within the school group area. In all cases the salmon trollers were in or at the seaward edge of the anchovy school group. A total of 255 salmon trollers was sighted. Over 170 of them were in the area from Pt. Reyes to Fort Ross.

HOOK-AND-LINE FISHERMEN: For the first time this year the area to the north of Fort Bragg was surveyed for sport fishermen, but few were seen in this northern area. Only 10 surf fishermen were sighted north of the Russian River, and 4 were surf-netters in quest of the daytime spawning silver smelt (*Hypomesus*).

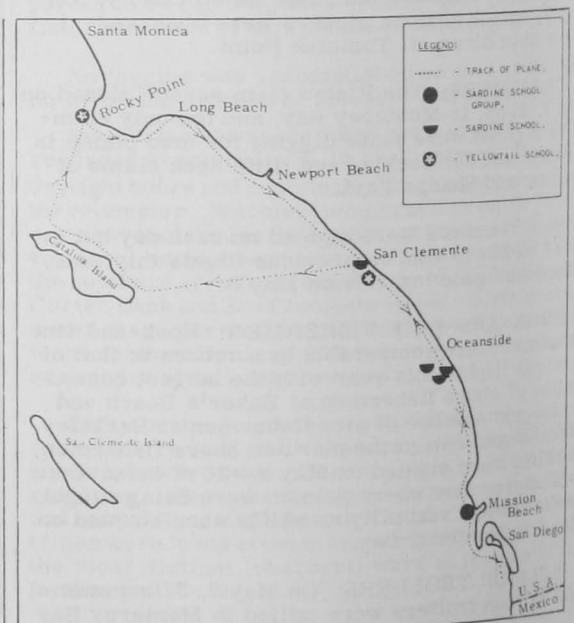
From the Russian River to Monterey the favorite shore fishing areas continued to be on the beaches near San Francisco and in Monterey Bay.

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PELAGIC FISH DISTRIBUTION AND ABUNDANCE OFF SOUTHERN CALIFORNIA OBSERVED BY AERIAL SCOUTING (Airplane Spotting Flight 58-5): The mainland coast between Rocky Point (Santa Monica Bay) and San Diego; the ocean area between the city of San Clemente and the east end of Santa Catalina Island; the inshore waters along the northeast shore of Santa Catalina Island; and the ocean area between the west end of Santa Catalina Island and Rocky Point were scouted from the air on May 8, 1958, to study pelagic fish distribution and abundance off Southern California and to familiarize new personnel with aerial spotting techniques. The scouting was conducted by the California Department of Fish and Game with its Beechcraft plane.

Initially, 2 days were scheduled to scout the desired area but due to a heavy overcast, only 3½ hours during the afternoon of May 8, 1958, could be spent in the air. Even then, haze and generally poor visibility hampered the operation and resulted in an unsatisfactory flight.

No fish were sighted offshore or along the inner shoreline of Santa Catalina Island. Aside from a single, medium-size school of fish off Rocky Point,



Airplane Spotting Flight 58-5 of May 8, 1958.

Santa Monica Bay--tentatively identified as yellow-tail--the only schools observed were along the mainland shore between San Clemente and Mission Beach.

One group of 10 small sardine schools was sighted off Mission Beach.

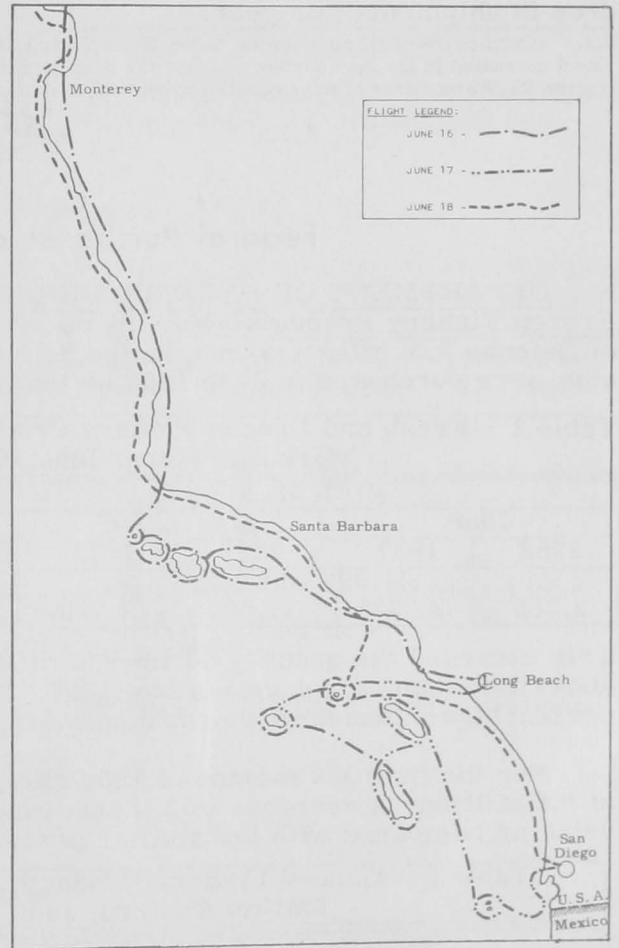
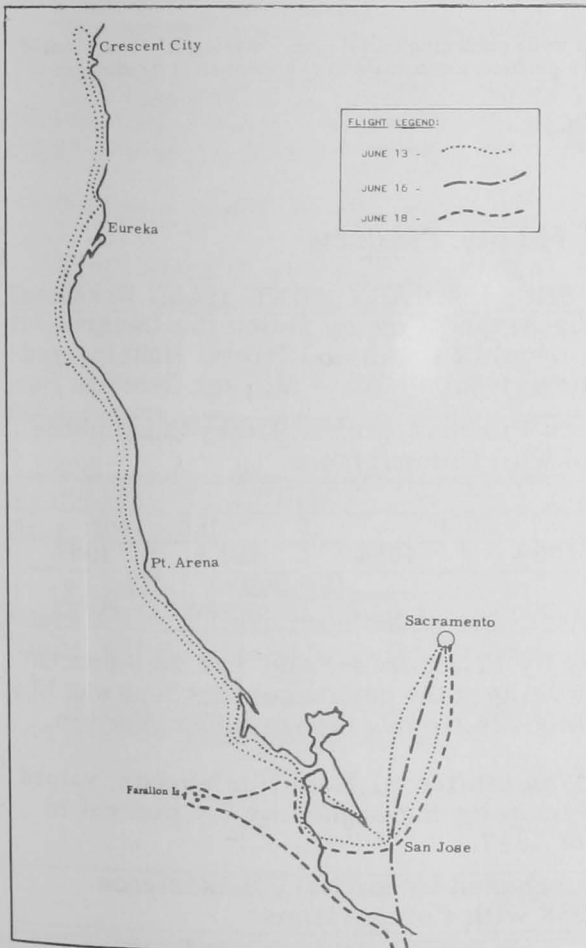
A large, fast-moving school of big fish--assumed to be yellowtail--was seen breaking the surface of the water just outside the kelp, off San Onofre. Individual fish in this school were easily distinguishable from an altitude of 1,500 feet; they were grey-brown in appearance and "flashed" frequently within the school.

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CENSUS OF SEA LION POPULATIONS OFF COAST OF CALIFORNIA (Airplane Spotting Flight 58-9): A census of the Stellar and California sea lion populations off California was conducted by the California Department of Fish and Game's Beechcraft plane from June 16-18, 1958.

The days selected for the sea lion census survey were in general good, insofar as atmospheric conditions were concerned; however, morning fog and local concentrations of fog of the Channel Islands limited observations mainly to the afternoon periods.

Significant or large concentrations of the animals were photographed on their rookeries and hauling-out grounds. The entire coast was covered with the exception of two small sections between San Mateo Pt. and Long Beach, and between



Airplane Spotting Flight 58-9 on sea lion census, June 13, 16, & 18.

Airplane Spotting Flight 58-9 on sea lion census, June 16, 17, & 18.

Santa Monica and Redondo where significant concentrations of sea lions have never been found in the past. Pictures were taken at elevations ranging between 500 and 1,500 feet. Strip-photographic methods were used for areas where the sea lion concentrations were spread out over relatively long lineal distances and single or overlapping photographs were taken of the smaller groups. Wherever possible, visual

estimates of the number of sea lions were also made. In those areas where small numbers of animals were present, visual counts only were made.

Visual estimates indicated that the Channel Islands, Santa Barbara Island in particular, appeared to have the greatest concentrations of sea lions. During past censuses the largest numbers were found at Ano Nuevo Island.

Note: Coverage of restricted offshore Southern California islands was made through cooperation of the United States Navy, 11th Naval District.



Cans--Shipments for Fishery Products, January-May 1958



Total shipments of metal cans during January-May 1958 amounted to 37,143 short tons of steel (based on the amount of steel consumed in the manufacture of cans) as compared with 54,426 tons in the same period a year ago. Canning of fishery products in January-May this year was confined largely to tuna. Holdover stocks of metal cans from the 1957 season, plus light packs of shrimp, mackerel, and sardines during the first five months of 1958 may account for the sharp drop in shipments this year.

Note: Statistics cover all commercial and captive plants known to be producing metal cans. Reported in base boxes of steel consumed in the manufacture of cans, the data for fishery products are converted to tons of steel by using the factor: 23.0 base boxes of steel equal one short ton of steel.



Federal Purchases of Fishery Products

DEPARTMENT OF DEFENSE PURCHASES, JANUARY-JUNE 1958: Fresh and Frozen Fishery Products: For the use of the Armed Forces under the Department of Defense 2.3 million pounds (value \$1.3 million) of fresh and frozen fishery products were purchased in June 1958 by the Military Subsistence Market Centers.

Table 1 - Fresh and Frozen Fishery Products Purchased by Military Subsistence Market Centers, June 1958 with Comparisons

QUANTITY				VALUE			
June		Jan.-June		June		Jan.-June	
1958	1957	1958	1957	1958	1957	1958	1957
(1,000 Lbs.)				(\$1,000)			
2,285	2,023	11,595	12,025	1,306	1,039	6,600	6,145

This exceeded the quantity purchased in May by 11.2 percent and was 13.0 percent above the amount purchased in June 1957. The value of the purchases this June was 13.4 percent higher than the previous month and almost 26.0 more than in June a year ago.

For the first six months of 1958 purchases totaled 11.6 million pounds, valued at 6.6 million--a decrease of 3.6 percent in quantity but higher by 7.4 percent in value as compared with the similar period of 1957.

Table 2 - Canned Fishery Products Purchased by Military Subsistence Market Centers, June 1958 with Comparisons

Product	QUANTITY				VALUE	
	June		Jan.-June		June	Jan.-June
	1958	1957	1958	1957	1958	1958
	(1,000 Lbs.)				(\$1,000)	
Tuna	513	263	1,713	1,450	250	890
Salmon . .	73	-	1,400	992	44	768
Sardine . .	9	13	42	86	3	15

Prices paid for fresh and frozen fishery products by the Department of Defense in June 1958 averaged 57.2 cents a pound, about 0.9 cent a pound higher than the 56.1 cents paid in May and 5.8 cents above the 51.4 cents paid during June a year ago.

Canned Fishery Products: Tuna was the principal canned fish purchased for the use of the Armed Forces during June. The total quantity of canned tuna, salmon, and sardines purchased for the first six months (3.2 million pounds) was about 27.6 percent higher than the total for the comparable period of 1957.

Note: Armed Forces installations generally make some local purchases not included in the data given; actual total purchases are higher than indicated, because it is not possible to obtain local purchases.



Fisheries Loan Fund

LOANS THROUGH JULY 14, 1958: As of July 14, 1958, a total of 453 applications for fisheries loans totaling \$16,332,773 had been received. Of these, 244 (\$5,692,079) have been approved and 146 (\$4,484,535) have been turned down. As several applications have been deferred indefinitely at the request of the applicants and collections have been coming in, sufficient funds have been available to process all other applications received to date.

The following loans have been approved between May 14, 1958, and July 14, 1958:

New England Area: Willard-Daggett, Inc., Portland, Maine, \$70,000; Harold S. Chilles, Vinalhaven, Maine, \$1,100; Joseph Giacalone, Medford, Mass., \$22,000; Elmer Jacobsen, Marion, Mass., \$60,000.

Middle Atlantic Area: James Beebe, Islip, N. Y., \$7,722.

South Atlantic and Gulf Area: Simmons and Carrier, Southport, N. C., \$12,233; Thomas P. Duke, McClellansville, S. C., \$38,000; Porpoise Fish Co., Beaufort, S. C., \$24,509; John Clifford Smith, Charles City, Va., \$5,000; Herbert M. Sorter, Naples, Fla., \$27,758; Leo Angelette and Eugene Lafort, Cut Off, La., \$14,526; Herbert Galjour, Cut Off, La., \$12,385; Burke Collins and Alidore Bruce, Galiano, La., \$24,862; Robert J. Theriot, Houma, La., \$11,861.

California: M. Machado Medina, et al., San Diego, Calif., \$86,000; Zarco Fishing Co., San Diego, Calif., \$35,000; August John Felando, Jr., et al., San Pedro, Calif., \$73,000.

Pacific Northwest Area: Adolph Sandness, Bellingham, Wash., \$3,260; Eldon Roger Wills, Friday Harbor, Wash., \$5,669; Fishing Vessel Seattle, Port Blakely, Wash., \$10,850; Floyd D. Furfiord, Westport, Wash., \$6,000.

Alaska: Joseph E. Ott, Pelican, \$1,400; Howard E. White, Petersburg, \$25,000; Leo Lyster, Wrangell, \$14,500.



Fish Meal

RECENT CALIFORNIA MARKETING TRENDS: The shortage of wet fish (sardines, mackerel, and anchovies) and the use of more dark or red meat from tuna for pet food have resulted in short supplies of California fish meal, and brokers in that State have stepped up importation of meal from foreign countries, according to a report from a Market News Reporter at San Pedro.

The chief port of entry in California for imported meal is San Francisco, and the imported meal comes mainly

California Fish Meal Imports					
Country of Origin	Peru	Chile	Mexico	Norway	Total
..... (Million Pounds)					
1958 Jan.-May	15.7	4.3	1.0	0.1	21.1
1957 Jan.-May	11.2	-	0.5	-	11.7
1957 Total	12.7	0.6	0.8	0.3	14.4

from Peru, where it is produced from a small variety of the true anchovy (*Engraulis Ringens*). There are, at present, about 36 reduction plants in Peru engaged in the manufacture of fish meal and oil; half of these operating in conjunction with canneries. Other main sources of meal imported into California (in order of importance) are Chile, Mexico, and Norway.

The increase in imports of meal into California from foreign countries for the first four months of 1958 with



comparisons are shown in the table. The imports are expected to rise sharply if the shortage of California wet fish continues. In 1957, imports dropped sharply after the first half of the year because of good California mackerel production.

Imported fish meal prices are usually several dollars per ton less than domestic production; but, according to brokers, the mixer prefers domestic meal for several reasons: (1) imported meal is almost 100-percent burlap bagged; (2) quantities have to be bought in large lots rather than by delivered order; (3) the buyer must remove meal from the dock before the seven-day free period allowed by port authorities is up; and (4) poor weights per 100-pound sack that may vary 2 to 3 pounds either way. Additionally, the protein units are generally higher—about 65-70 percent as against California's 60 percent, so that when using imported meal, mixers claim extensive formula manipulation is necessary which adds to the expense of their operation. The reason for the greater protein content of foreign meal is that whole fish is used in the manufacture of meal while domestically waste or only the parts of the fish not canned or otherwise utilized are used. Lowering the protein content is difficult; water, oil, or bone meal has to be added which has to be obtained from some other source.

The demand for fish meal has greatly stepped up production in Peru and Chile, and no doubt has resulted in the expansion of facilities. If there is a return of California wet fish, as is expected, California-produced meal will have to meet increased competition.



Florida

FISHERIES RESEARCH: Fisheries research conducted by the Marine Laboratory of the University of Miami with funds provided by the Florida State Board of Conservation, the U. S. Fish and Wildlife Service, and private sources as reported in the July 1958 Salt Water Fisheries Newsletter from that Laboratory.

Shrimp Studies: Since the shrimp fishery is Florida's most valuable single resource, a great deal of the research effort is being devoted to studying the various aspects of the life history of the shrimp which affect the yield of the commercial fishery. At present most of the studies have been concerned with the Tortugas fishery.

The tag being used at present consists of two green plastic discs attached by a pin that pierces the mid-section of the body. Information on size distribution by depth of water, growth, migrations, and fishing intensity is also being collected by monthly sampling trips on a chartered shrimp trawler. Many shrimp dealers have permitted the examination of historical records of catches. These suggest that the catch per unit of effort since 1950 has shown little change. These records have also provided a great deal of other useful and interesting data, such as annual and seasonal changes of abundance.

Another important part of the shrimp studies is the one being conducted by a student working on a fellowship provided by the Shrimp Association of the Americas on the spawning habits. Samples are being obtained monthly from the commercial fishery and the degree of maturity is being measured by different methods. Preliminary observations suggest that while spawning might take place throughout the year, the peak of spawning activity occurs in the spring and the fall.

Scallop and Clam Studies: Exploratory fishing studies with commercial gears have been initiated to determine the possibility of expansion of the commercial fisheries for these species. The scallop studies are being made in the Cedar Key area and the clam study in the waters of Collier County.

Florida Bay Studies: In association with the shrimp biology and tagging experiments in Florida Bay, other animals and plants and the water conditions are being studied there. This work can help the fishing industry by finding out the conditions required by the important species for survival, particularly in their early life. This information is especially important to Florida where so many changes are being made in the natural habitats through dredging, filling and other land development and

pollution activities. The Everglades National Park area was chosen for this work because it was considered to be fairly typical of Florida's inshore environment, it was an area where a wide variety of animals live and it has been subjected to few manmade changes. The effects of temperature, salinity, oxygen saturation, total sulphide production, turbidity and other chemical and physical factors on the marine life are being measured. The effects of the recent unseasonable weather is proving of particular interest.

Spotted Sea Trout Studies: The spotted sea trout in the Indian River area was studied last year. The trout in other parts of the state appear to differ in growth rate and in other ways from those in the Indian River. To investigate the reasons for the difference and because it is an important species to the area, spotted sea trout studies are now being done in the Apalachicola-St. Marks area. The factors being investigated include age and growth, spawning time, feeding habits, and the chemical and physical nature of the water in which the fish are living. Other species present in the area are also being collected and identified.

Synthetic Crab Baits: The crab industry in some parts of the State has recently experienced difficulties in obtaining fish in a large enough quantity and at a low enough price as bait for their crabbing operations. The possibility of developing a synthetic crab bait was suggested. If such a bait, attractive to crabs, yet of low cost could be developed it would be of benefit to the industry. Balsa wood, rubber, plastics, and gelatine have been impregnated with fish oils, blood, and other similar products under pressure. These have been tested in commercial crabbing operations along with regular baits. Preliminary results with balsa wood and menhaden oil are encouraging and the tests are continuing.

Quality Control of Fish: Two of the most important changes that occur in frozen fish are the development of rancidity and the loss of the characteristic color. Rancid or stale odors or flavors result when unsaturated fat in the fish is oxidized. The oxidation is slowed but not prevented by low temperature storage. Chemicals called antioxidants can be used to retard oxidation and hence the occurrence of rancidity. One chemical tested so far with encouraging results is butylated hydroxytoluene (BHT) in varying concentrations and in combination with other chemicals. Spanish mackerel, an oily fish, much subject to rancidity is being used in the present experiments.

The retention of the characteristic red color in red snapper is the object of another experiment. The antioxidant BHT, which is also proving its usefulness in combating rancidity, is helping to retain the color after prolonged storage. Other chemicals have also given encouraging results for this purpose.

Studies on the prevention of bacterial spoilage and black spot formation in shrimp have been under way for a few years and important discoveries have been made. Among the antibiotic chemicals tested, aureomycin and other

similar products have proved effective in retarding spoilage caused by bacteria. This year, other products, some of which are giving promising results, are being tested.

The use of these chemicals by the fishing industry awaits the approval of the Food and Drug Administration and the Marine Laboratory is playing its part in testing for any possible harmful side effects from their use. Studies on the types of bacteria which cause spoilage and on their tolerances of certain conditions are also being made by the Marine Laboratory technologists.



Frozen Processed Fishery Products

CONTRACT LET FOR STUDY OF INSTITUTIONAL CONSUMPTION: A study of frozen processed fish and shellfish consumption in institutions and public eating places in 10 selected cities will begin shortly. A contract for \$57,000 was awarded in July by the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, to Crossley, S-D Surveys, Inc., of New York City. The survey will be financed from funds provided by the Saltonstall-Kennedy Act to increase production and markets in the domestic fishing industry.

Since the mass feeding industry is among the best of all potential markets for frozen fishery products, the Bureau proposes to obtain information through this study which will benefit the fishing industry in finding ways to diversify and increase the use of fish and shellfish in these establishments.

The cities involved in the survey are Atlanta, Ga., Chicago, Ill., Cleveland, Ohio, Denver, Colo., Houston, Tex., Los Angeles, Calif., New York City, Omaha, Nebr., Portland, Oreg., and Springfield, Mass. They have been selected because they are fairly well distributed geographically and account for a good proportion of the consumption of frozen fish and shellfish by mass-feeding establishments.

"Mass-feeding" establishments include: (1) restaurants, cafeterias, and eating places in hotels, (2) eating places in schools, dormitories, industrial plants, and office buildings, (3) hospitals, prisons, and other similar public and private institutions, and (4) department stores or drug stores serving food, lunchrooms, etc.

The survey is scheduled for completion within 10 days.



Groundfish

BROAD ANALYSIS OF NEW ENGLAND GROUND FISH INDUSTRY PROBLEMS PLANNED: A study to determine the underlying economic and technological factors which may dictate the long-term competitive status of the New England groundfish industry is being made by the U. S. Department of the Interior.

A contract to make this analysis has been awarded to Boston College by the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service. The contract price is \$31,700. Boston College's Bureau of Business Research will conduct the study.

The work will necessarily involve collection and compilation of comparative cost data. However, the Bureau is asking that the study "go behind such cost data" and establish, by basic economic and sociological analysis, the reason for cost differentials. The Bureau wants to have explored the present and future alternative economic opportunities available to capital and labor, the degree of dependence of

the area upon the fishery, the growth of other industries and their demands upon investment capital and labor supply, and the effect of changes in social habits.

Among the factors which will be evaluated are the cost of production, and the availability of the groundfish resources; the labor market; living standards; management of capital in terms of types of vessels and equipment; primary marketing arrangements; and the role of governmental bodies in terms of capital grants, subsidies, price supports, research, and tariffs. The Bureau of Business Research of Boston College expects to assemble and evaluate available source material influencing the general economic and social trends and to compile cost of production data from published or unpublished material already available.

A secondary feature of the contract with Boston College is to make a limited evaluation of the sea scallop fishery in relation to its general economic background.

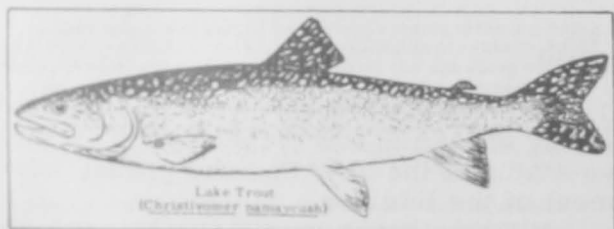


Great Lakes Fishery Investigations

LAKE SUPERIOR BIOLOGICAL RESEARCH PROGRAM, 1958: The initiation of intensive sea lamprey control on Lake Superior by the Bureau of Commercial Fisheries makes it most important to study the abundance, distribution, and biology of fish inhabiting the lake. The presence of the lamprey influences nearly every species of fish to some degree. Species directly affected by the predator, and species of existing or potential commercial importance, require early consideration. Their abundance and availability will determine the success of the fishery during the periods of intensive lamprey control and lake trout rehabilitation. It is also necessary that environmental conditions be measured to aid in understanding changes in the fish populations that have occurred and may continue to take place.

Suggested objectives and approaches to the problems of Lake Superior have come from the several states and province surrounding Lake Superior through the Great Lakes Fishery Committee and from the Great Lakes Fishery Commission through its Scientific Advisory Committee.

The lake trout, lake herring, and whitefish have been the most important species in the United States



waters of Lake Superior, averaging over 98 percent of both the total catch and ex-vessel value over the last 10 years of record (1947-1956). The lake trout which contributed 18 percent of the poundage (2,642,000 pounds) and 55 percent of the value (\$1,087,000) over this period has been most seriously depleted by the lamprey. Maintenance of the fishery must now rely more heavily on species less affected by the lamprey or on stocks not now fully exploited.

Depletion of the lake trout population is reflected by the continuous decline in United States commer-

cial production from 3.2 million pounds in 1950 to a catch of 1.8 million pounds in 1956. The incidence of lake trout bearing lamprey scars increased from 3 to 27 percent over this same period while large fish became less frequent and spawning stocks greatly diminished--all symptoms of depletion resulting from lamprey predation that were demonstrated in Lakes Michigan and Huron. Current measures for controlling the sea lamprey should save the lake trout from the near extinction that occurred in Lake Michigan, but cannot halt the economic depression that is already upon the fishery.

The whitefish which contributed 6 percent of the United States poundage (880,000 pounds) and 18 percent of the value (\$358,000) of the total catch in 1947-56 has provided a supplemental source of income to the Lake Superior fishery. Preliminary evidence has shown that some local populations may not be cropped most efficiently under present fishery regulations and could be more useful in providing immediate relief for the industry. It has been demonstrated in other lakes, however, that the whitefish is subject to depletion by the lamprey following the extreme reduction of the lake trout stocks and consequently can be considered only of temporary value in lessening the distress of the fishery.

Although the lake herring has supplied 74 percent (11,219,000 pounds) of the total United States catch over the past 10 years of record (1947-1956), it has produced only 25 percent (\$503,000) of the total income of Lake Superior fishermen and vessel owners. The low value of this fishery has resulted in large measure from the seasonal nature of production and the resulting market gluts--79 percent of the annual catch is taken during about 3 weeks in November or December. This very abundant species has been affected little by lamprey predation in other lakes. If the same holds true in Lake Superior, it may be of great value in providing continued support to the fishery. For use to maximum economic advantage, however, it must be cropped more evenly throughout the year.

Other abundant species not fully utilized by the fishery are the chubs (deep-water ciscoes), smelt, menominee whitefish, and suckers. Problems of distribution, abundance, fishing methods, effects

of increased production, and markets must be explored for these species to determine the contribution they could make to the fishing industry.

Fishery-Limnological Surveys: The research vessel *Siscowet* has been reconstructed so it can be used in lakewide operations in Lake Superior, and to handle various types of experimental fishing gear and limnological equipment. This boat will be a major tool in the 1958 field studies in gathering data on species composition, distribution, abundance, . . . of Lake Superior fish and on the environmental conditions under which the fish live.

Fishery and limnological surveys will, except for cruise 5, be concentrated in the area west of Ontonagon, Mich. These surveys will be designed to collect information on all species in the area and on general limnological conditions. Cruise 5 in the Isle Royale area will include collection of data on the abundance and distribution of lake trout, whitefish, lake herring, and other species of the area. Studies of lake herring emphasize the distribution and habits during summer.

In addition to work conducted from the *Siscowet*, inshore fishery and limnological studies will be carried on from a 16-foot boat powered with an outboard motor and equipped for trawling. Collections will also be made from the commercial fishery.

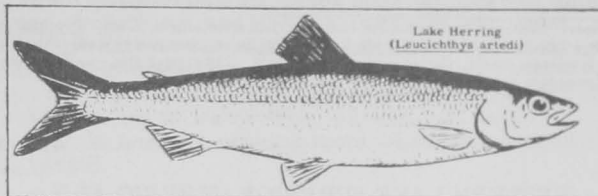
Lake Trout Studies: Studies of the lamprey-occurring rate and composition of the lake trout in the commercial catch will be continued. Records of returns of tagged and fin-clipped trout released in the lake in recent years will be accumulated as in the past. These operations will continue to be restricted, mainly to the Marquette area.

Studies of the abundance of immature lake trout will be intensified. This information is of vital importance in developing and maintaining an index of the status and changes in stocks of lake trout that are small enough to be partly free from lamprey predation. It was demonstrated in Lake Michigan that the commercial chub fishery can serve as a source of valuable data on the abundance of small trout. The success of the project in Lake Superior depends, however, on the submittal by the commercial fishermen of accurate records of lake trout catch in chub nets. An attempt will be made to obtain the data required for satisfactory estimates of the status and changes in the population of immature lake trout.

In some areas where the commercial fishery for chubs is nil or limited, the *Siscowet* may be used in special studies to obtain information on the lake trout population. Collections on regular cruises of the vessel will also be designed to obtain distributional and biological information not available from the commercial fishery.

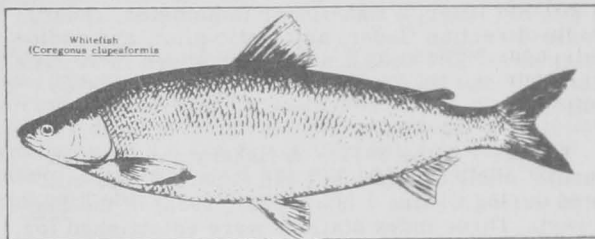
Lake Herring Studies: Information on the distribution of lake herring during the summer is scanty. Greater knowledge of the summer habitat is of vital importance in gaining a better understanding of factors influencing the herring populations. Knowledge of summer distribution may permit the development of a fishery for this very abundant species throughout much of the year and thus make possible more orderly marketing at better prices.

The *Siscowet*'s even-numbered cruises will be spent in studies of the distribution and habits of the lake herring from early summer up to the spawning period. Sweeps will be made with a special fish-magnifying fathometer to learn where and at what level lake herring are found. When they have been located, experimental fishing gear of several types will be used to sample the herring to determine their com-



position, habits, and concentration. If herring schools are found near the surface in summer, flights will be made to determine if the schools can be spotted from an airplane and information on size, distribution, and frequency of schools will be gathered.

Whitefish Studies: Research initiated in 1957 to determine the growth characteristics, and age and size composition of the local whitefish populations



of Lake Superior will be continued. Much of this information will be collected from the fishery. Findings may permit recommendations for more efficient harvesting of the stocks. Additional information on the distribution, abundance, and biology of whitefish that have not entered the commercial fishery will be gathered in fishery and limnological surveys of the *Siscowet*. In fact, a primary objective of cruise 5 to the Isle Royale region will be to study the abundance and distribution of whitefish in that area.

Other Species: The fishery and limnological surveys of the *Siscowet* will be designed to obtain information on all species of fish. Particular emphasis, however, will be given to those species that may be of greater use in the commercial fishery--chubs, smelt, menominee whitefish, and suckers. All of these fish are in greater abundance, local or lakewide, than has been reflected in the commercial catch. It has been demonstrated at other times in Lake Superior or in other lakes that these species have a market potential not now realized in Lake Superior. Information on the distribution and abundance of species in this group will be gathered to produce data needed to evaluate their potential contribution. Where possible, additional knowledge will be accumulated on other less abundant yet locally-important species such as northern pike, yellow pike (walleye), yellow perch, sauger, and carp, and on forage fish serving as food of piscivorous species.

Environmental Studies: Some general limnological features of Lake Superior were brought out by the work of the U. S. Bureau of Commercial

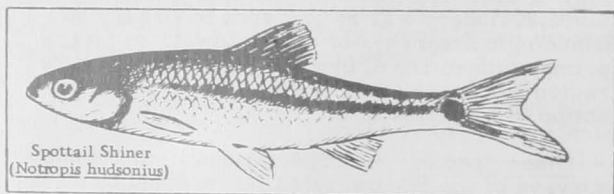
Fisheries research vessel Cisco in 1952 and 1953, and in other studies. Due to its size, depth and low content of organic and inorganic constituents, this lake presents some special problems of measurement, analysis, and interpretation. Some studies during fishery and limnological cruises of the Siscowet will be directed toward refining these procedures and techniques. Preliminary work will be done to establish long term "environmental-index"

Note: Common and scientific names of fish mentioned: Carp, Cyprinus carpio; chubs (deep-water ciscoes), Leucichthys spp.; lake herring, Leucichthys artedii; lake trout, Salvelinus namaycush; menominee (round) whitefish, Prosopium cylindraceum; northern pike, Esox lucius; sauger, Stizostedion canadense; smelt, Osmerus mordax; suckers, Catostomus spp.; yellow pike or yellow pike-perch (walleye), Stizostedion vitreum vitreum; whitefish, Coregonus clupeaformis; yellow perch, Perca flavescens.

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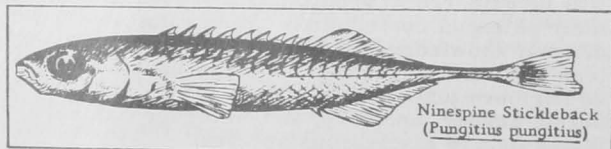
WESTERN LAKE SUPERIOR HERRING AND GENERAL FISHERY SURVEY (M/V Siscowet): The M/V Siscowet was recently converted from a Great Lakes gill-net tug to a fishery and hydrographic research vessel for the U. S. Bureau of Commercial Fisheries Great Lakes Fishery Investigations in Lake Superior. The vessel is powered by a 147-horsepower Diesel engine, is 53 feet long, with a 15-foot beam and 6-foot draft, and weighs 43 tons. The Siscowet has sleeping accommodations for 5 people, a galley, and laboratory facilities, and is equipped with trawling and hydrographic winches, a gill-net lifter, a fish-finder fathometer, radar, radio-direction finder, automatic pilot, and radio-telephone. The vessel's cruising speed is 10 miles per hour and its cruising radius exceeds 1,100 miles.

Cruise 1 (June 3-11): A fishery and environmental study of western Lake Superior was initiated during Cruise 1 (June 3-11, 1958) of the Siscowet. Three index stations were established for measuring species composition, abundance of fish, and recording environmental conditions. These stations are located (1) north of Little Girls Point, Mich., (2) southeast Stockton Island, and (3) northeast of Bear Island (two of the Apostle Islands, Wis.). Fish were collected with gill nets and trawls at



each station, and samples were taken for studies of plankton, bottom fauna, and water chemistry. Bathythermograph casts were made at and between stations. These stations will be visited periodically to determine the seasonal and annual changes that may occur.

Trawl catches at all stations were light. The slimy muddler and ninespine stickleback dominated in most catches. Other species taken were



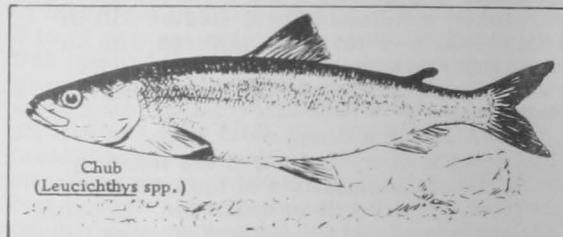
trout-perch, smelt, pigmy whitefish, burbot, and chubs. Only two lake trout were taken in trawl tows.

stations for measurement of trends in lake characteristics.

During all cruises of the Siscowet and in other studies, limnological data will be collected to establish the environmental preferences and requirements of the various species of fish. These data will be used wherever possible to interpret the distributional and biological traits of the species.

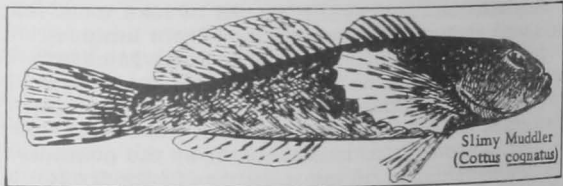
Gill-net catches were somewhat better with chubs dominating catches in depths of 22-35 fathoms. Longnose suckers and menominee whitefish were the best represented species in nets fished in depths of 1-17 fathoms.

Although inshore areas had some temperature drop between the surface and bottom, no well defined thermocline had developed. Surface temper-

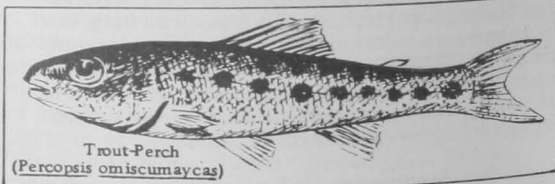


atures remained close to 45° F. (7.2° C.) and bottom temperatures 40° F. (4.4° C.) in the area covered. Open lake areas were homothermous.

Cruise 2 (June 23-July 11): Was devoted to gathering data on the summer distribution of the lake herring



in Western Lake Superior. Four sampling stations were established (1) northwest of Sand Island, (2) northwest of Rocky Island, (3) west of South Twin Island, and (4) north of Outer Island, all in the Apostle Islands, Wis. Bull nets (gill nets 300 feet long and 25

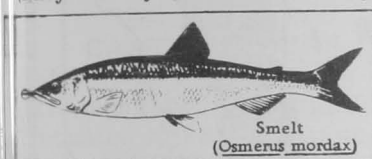


feet deep) with mesh sizes of 2½ and 2¾ inch were set at each station at various depths below the surface. These sets will be repeated at these stations throughout the season to follow changes in distribution of herring. These nets may also be set in other areas of the lake if required to gather additional data or to follow movements of herring.

Water temperatures were recorded and plankton and bottom samples collected at each station. Plankton samples were collected repeatedly throughout the

might at one station to detect possible changes in vertical distribution. With the exception of one set, all nets were anchored. Other nets were floated at depths of 6, 26, 46, and 66 feet below the surface. The depth of the water among the 4 stations ranged from 25 to 240 feet. At one station the nets were set at 5 and 26 feet below the surface in water 60-240 feet deep, and drifted throughout the night using the boat as a drift to pull the nets along. These nets measured 1,500 feet and drifted about 4 miles before being lifted. Where possible, trawl tows were made at each station concurrent with gill-net sets.

Catches in the trawl were predominately nine-spine sticklebacks and the slimy muddler. Species less common in the trawl catches were chubs (hoi and kiyi), smelt, and longnose suckers. In



Smelt
(*Osmerus mordax*)

many cases bottom conditions did not permit trawling.

Lake herring were taken in a

undance only at the station northwest of Sand Island where the water was 180 feet deep. Bull nets set with cork lines 6 and 26 feet below the surface took 269 herring ranging from 9-14 inches long. In this set no herring were caught in depths above about 16 feet. The following night nets were set at this same location with cork lines 26, 46, and 66 feet below the surface and 40 herring were taken. Less common species taken in the bull nets were chubs (hoi and kiyi), smelt, and lake trout. Sets in shallow water (20-25 feet) predominately caught menominee whitefish, longnose suckers, and burbot, and very few herring. The drifting set, which drifted in water from 60-240 feet deep, caught 32 herring ranging from 14 to 16.5 inches in length.

Although the weather on Lake Superior has been unseasonably cold and windy, the water north of Outer Island was becoming thermally stratified. Surface temperatures varied from 47° to 51° F. (8° to 11° C.) with a definite thermocline occurring between 50 and 100 feet, below which the temperature was about 40° F. (4° C.)

Note: Common names for chubs vary throughout the Great Lakes and sometimes the same name may apply to different species in different lakes. Therefore the various species of chubs are designated by their specific name to avoid confusion.

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SURVEY OF WESTERN LAKE ERIE FISH POPULATIONS CONTINUED (M/V CISCO Cruise 6):
In spite of delays due to engine repairs, the U. S. Bureau of Commercial Fisheries research vessel Cisco visited all 10 of its regular trawling stations in western Lake Erie during the July 9-21, 1958, cruise. Limited trawling was also done in Sandusky Bay. The most striking feature of the catches was the almost complete lack of smelt (other than fry), as contrasted with the large catches of smelt in the previous cruise. Smelt fry were common everywhere, but larger smelt were numerous only north of Pelee Island. Apparently most of the larger smelt have moved into the cooler waters of the central and eastern basins.

Yellow perch predominated in most of the catches. Several of the yellow perch bore small, fresh lamprey scars, and one silver lamprey (*Petichthys unicuspis*) was taken in a catch which contained one of these scarred fish. The presence of large numbers of yellow perch fry in many areas suggests the possibility of a highly successful 1958 hatch. Other species taken in abundance were sheepshead, emerald shiners, spot-tail shiners, and trout-perch.

Some sheepshead had still not spawned, but most of the smaller mature ones were spent. A few

sheepshead fry were caught. The sheepshead spawning season appears to extend over a longer period of time than for most other species. Trout-perch had, with an occasional exception, completed spawning, and a few fry of this species were also taken. Most spot-tail shiners had spawned, but emerald shiners had not begun.

The following species were taken in small numbers: yellow pike (walleye), burbot, channel catfish, brown bullhead, stonecat, logperch, sand darter, carp, goldfish, white sucker, silver chub, white bass, smallmouth bass, white crappie, alewife, gizzard shad, and mooneye. The latter four species were taken only in Sandusky Bay.

Surface water temperatures were appreciably warmer than during the previous cruise, ranging mostly from 22° to 24° C. (71.6° to 75.2° F.). Extremes were 20.8° and 26.1° C. (69.4° and 79.0° F.). There was no well-marked thermal stratification in the western basin, but east of Sandusky, barely in the central basin, a thermocline existed at about 6-fathoms depth. Oxygen was quite scarce below the thermocline with concentrations as low as 1.6 parts per million recorded. Catches were very small in the area of lowest oxygen concentration.

Note: See Commercial Fisheries Review, July 1958, p. 29, for scientific names of fish mentioned in this and the previous article.



Gulf Exploratory Fishery Program

GULF OF MEXICO EXPLORED FOR HARD CLAMS AND SCALLOPS (M/V Silver Bay Cruise 10):
Explorations to assess the hard clam and scallop resources in the Gulf of Mexico on the continental shelf along the coasts of Florida, Alabama, and Mississippi were conducted by the exploratory fishery vessel M/V Silver Bay of the U. S. Bureau of Commercial Fisheries during a cruise which began

on July 17 and ended on August 4, when the vessel returned to Pascagoula, Miss.

A total of 202 stations were made between Cape Romano, Fla., and Chandeleur Island, Miss., in depths ranging from 16 to 120 feet.

Sixty-nine tows were made between Cape Romano, Fla., and Anclote Keys with two 12-tooth "Fall

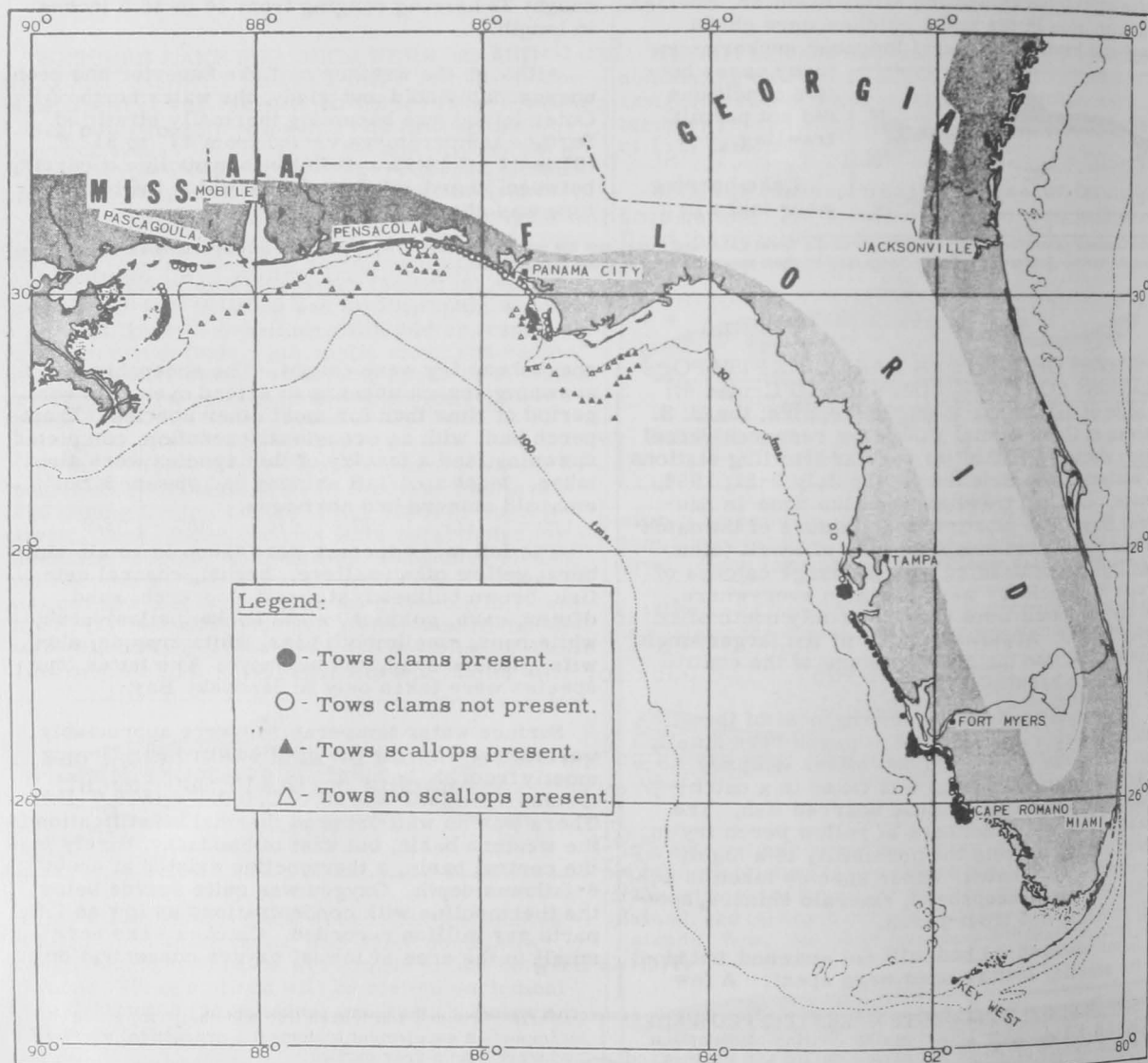
River" type hard-clam dredges. Hard clams (*Venus* sp.) were taken in all tows in this area where bottom conditions were suitable to the gear, with best fishing confined to the areas off Pass-a-Grille Beach, Venice, Fla., and Marco Island. The catch in these areas in depths from 16 to 22 feet (the vessel's deep draft, 13 feet, precluded any attempt to explore inside the 16-foot curve) varied from a few clams to a 1.5 bushels per 15-minute tow. One 5-minute tow slightly north of Venice with one dredge fishing produced a bushel of hard-shell clams. The clams range in size from 2" to 4½" with the bulk of the catch (75 percent) made up of 3" clams. Yield was approximately one gallon of meats per bushel

The clams were held in a wooden tank in which sea water was circulated continuously and were kept alive for 15 days with negligible loss.

Forty-six tows with the clam dredges between Cape San Blas and Horn Island in the 20-foot depth range failed to produce any hard clams.

The results obtained from this phase of the cruise suggest that the use of modern hydraulic dredging techniques will be required to fully evaluate the hard-clam potential of the Gulf of Mexico.

Eighty-seven tows were made with an 8-foot "Georges Bank" type sea scallop dredge south and



M/V *Silver Bay* Cruise No. 10 (July 17 to Aug. 3, 1958).

Though clams were taken in practically all tows west of Marco Island, considerable difficulty was experienced in this area due to the abundance of parchment worms on the bottom which clogged the teeth of the dredge, greatly reducing their efficiency. Hard sand and coral fragments also affected the efficiency of the dredges in many areas. This was partly overcome by substituting nylon line for towing warp in place of steel cable.

west of Appalachi Bay in depths of 5 to 20 fathoms in an attempt to delineate the grounds presently being fished for Gulf scallops (*Pecten gibbus*) and to discover and define any new scallop beds in the area.

The heaviest concentration of scallops presently fished here was found approximately 5 miles SSW. of St. Joseph Point, Fla., in 11 fathoms of water. Catches of 40 bushels per 15-minute tow were common in this area. Production fell off

considerably both shoaler and deeper than 11 fathoms; however, larger scallops (average 2 3/4") were present in the deeper water. The main bed appears to run for 10 miles in a northerly direction to a point south of Panama City. These scallops averaged approximately 2 1/4" in diameter and yielded approximately 2 quarts of meats per bushel. Texture and taste are comparable to the northern bay scallop.

Exploratory tows in an area approximately 20 miles ESE. of Cape St. George resulted in the discovery of an extensive bed of smaller Gulf scallops (av-

erage 1") in depths ranging from 10 to 15 fathoms. Production in this area ranged from 1 to 40 bushels per 30-minute tow. Another less extensive bed of small scallops (3/4" to 1" diameter) was found midway between Mobile and Pensacola in 10 to 15 fathoms.

Two-inch metal rings and connectors originally were used throughout the chain bags on both types of gear. However, as escapement of both clams and scallops was found to be excessive with this size ring and connector, a 2-inch stretched mesh line was used on all dredges.



Maine Sardines

CANNED STOCKS, JULY 1, 1958: Distributors' stocks of Maine sardines totaled 184,000 actual cases on July 1, 1958--26,000 cases or 13 percent less than the 212,000 cases on hand July 1, 1957. Stocks held by distributors on June 1, 1958, amounted to 237,000 cases, and on January 1, 1958, totaled 230,000 cases, according to estimates made by the U. S. Bureau of the Census.

Canners' stocks on July 1, 1958, totaled 386,000 standard cases (100 3/4-oz. cans), a decrease of 509,000 cases (57 percent) as compared with July 1, 1957, and a decrease of 65.3 percent (725,000 cases) from the 1,111,000 cases on hand January 1, 1958.

Table 1 - Canned Maine Sardines--Wholesale Distributors' and Canners' Stocks July 1, 1958, with Comparisons

Type	Unit	1957/58 Season					1956/57 Season			
		7/1/58	6/1/58	4/1/58	1/1/58	11/1/57	7/1/57	6/1/57	4/1/57	1/1/57
Distributors	1,000 Actual Cases	184	237	293	230	298	212	230	295	347
Canners	1,000 Std. Cases 1/	386	235	476	1,111	1,337	895	416	465	879

1/100 3/4-oz. cans equal one standard case.

The 1958 pack from the season which opened on April 15, 1958, to July 26, 1958, amounted to about 848,000 standard cases as compared with 1,216,000 cases packed in the similar period of 1957. The pack for the 1957 season totaled 2,117,151 standard cases.

For the 1957/58 season there was an available supply of 2,543,000 actual cases (426,000 cases carried over from the previous season plus the 2,117,000 cases packed during the season).



Marketing

EDIBLE FISHERY PRODUCTS MARKETING PROSPECTS.

SUMMER-FALL 1958: United States civilian consumption of edible fishery products per person during the summer and early fall may be a little under the year-earlier rate. With the population larger this year and supplies of processed fishery products likely to be down some, retail prices probably will at least equal the high level of a year earlier.

The total commercial catch of fish and shellfish usually begins to increase in early spring and reaches a peak at about midyear. This year the rise has been less than usual because of the cold, late spring and scarcity of fish and shellfish in the established commercial fishing areas. Unless the commercial catch this summer and early fall is especially large, the seasonal build-up in stocks of processed items will undoubtedly be lower than in recent years.

Imports of canned and frozen fish and shellfish, which are an important supplement to domestic production, may be no larger than a year earlier.

Through late spring, total supplies of edible fish and shellfish were a little lower than in the same part of 1957. Commercial landings were down somewhat, with the slight increase for the species marketed in fresh or frozen forms more than offset by the reduction for those used mainly in canning. As of early spring, imports of fresh and frozen tuna for canning were noticeably lower than a year earlier. Imports of frozen groundfish and ocean perch fillets through the end of May about equalled the year-ago level. Domestic stocks of processed fishery products were down, reflecting reduced levels of production and imports, and the continued relatively strong demand for these products.

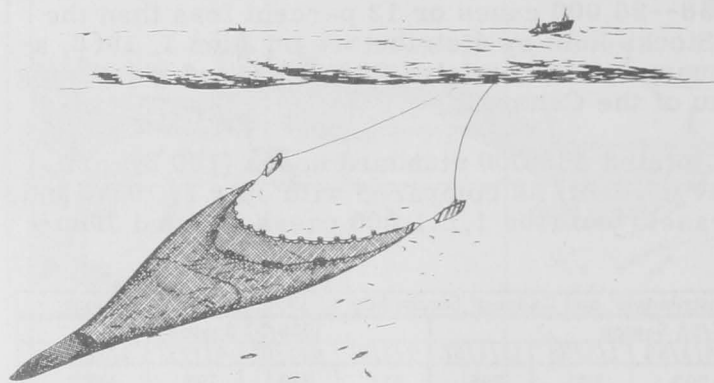
This analysis appeared in a report prepared by the Agricultural Marketing Service, U. S. Department of Agriculture, in cooperation with the Bureau of Commercial Fish-

eries, U. S. Department of the Interior, and published in the former agency's July 29, 1958, release of The National Food Situation (NFS-85).



Maryland

COMMERCIAL FISHERY LANDINGS AT OCEAN CITY, 1957: Commercial fish and shellfish landings at Ocean City, Md., showed apparent declines of 7 percent in quantity and 9 percent in ex-vessel value in 1957 totals as compared to 1956, according to the May-June 1958 Maryland Tidewater News of the Maryland Department of Research and Education. These fluctuations appear to be normal for the



Atlantic otter trawl.

ocean fisheries and the totals approximate the 13-year mean weight and value (base years 1944-1956). The 1957 statistics, as in past years, were compiled by the Maryland Department of Research and Education at Solomons from the records of licensed commercial fishermen and cooperative dealers.

this, the totals for bluefish, fluke, scup (porgy), spot, whiting, industrial fish, and conch rose during 1957. Spot showed the greatest increase for an edible fish species, when the catch rose to 2.5 times the 1956 catch. The croaker catch for the year dropped to one-half that of 1956.

The catch (both quantity and value) of butterfish, croaker, sea bass, sturgeon, gray sea trout, and surf clams reflected this general decline. Contrary to

Two changes in marketing have affected the fishery. One change, that of lower demand, caused a decline in surf-clam fishing effort and catch. This decrease in fishing effort and the resulting lower catch were due to internal changes of the industry, rather than to any depletion of surf-clam beds. The evidence indicated that the surf-clam beds can support the same amount of fishing as practiced since 1953, because trip catches were maintained at high levels by the active dredgers. Nevertheless, the 1957 total catch and ex-vessel value amounted to approximately three-fourths of the 1956 totals. The surf clam, which each year since 1953, except for 1955, had ranked first in ex-vessel value of all fish and shellfish landed at Ocean City, dropped to second place in 1957, below fluke. From 1953 through 1956, the surf clam accounted for 40 percent of the annual value of the Maryland ocean fisheries. In 1957 the surf-clam value dropped to $33\frac{1}{3}$ percent of the grand total.

The second change in marketing involved the industrial fish catch. Included in this classification are kinds of fish not generally used for human consumption, some examples of which are skates, sea robins, menhaden, and anglerfish. Traditionally, the ocean fishermen return such fish to the water, as they have been considered worthless. During recent years, however, a processor at Bishopville has begun to process industrial fish and scrap for chicken feed. Several trawlers from Ocean City have started supplying industrial fish to this processor. These trawler captains contend that since the non-commercial species have to be handled, they would prefer to get something for their trouble. One captain maintains that this catch pays his fuel bill each day. From these trawlers the 1957 catch of industrial fish

amounted to over 5 times that of 1956, while the 1957 value was over 12 times that of 1956.

Department biologists feel that the market for industrial fish can probably be expanded greatly at Ocean City. Possibly with a great expansion, facilities for processing would have to be located near Ocean City itself. A plant at Ocean City should result in higher prices to the fishermen since transportation costs of raw fish would be reduced. Other fishermen may consider handling this product at 80 cents or \$1.00 per 100 pounds against the 50 cents they can now expect.



National Fisheries Institute

CONSERVATION POLICY RESOLUTION ADOPTED AT 13th ANNUAL CONVENTION: Among several resolutions adopted at the National Fisheries Institute 13th Annual Convention held in San Francisco, April 19-23, 1958, was the following which is of considerable interest to the fishery and allied industries.

Resolution No. One - Policy on The Conservation of Natural Resources: "WHEREAS, the effective conservation of natural resources is essential for the well being of the commercial fishing industry; and

"WHEREAS, the demands of the Nation's growing population on natural resources have resulted in tremendous competition for water and associated land resources among the various segments of our economy, threatening the destruction of the quality and the reduction in quantity of much of the waters and lands needed as habitats for fishery resources, and closely related wildlife resources; and

"WHEREAS, the wise use and conservation of water and soil is a 'must' if fishery resources and wildlife resources are to survive to support the commercial and recreational industries which depend on those resources; and

"WHEREAS, the National Fisheries Institute, as representative of the Nation's commercial fisheries industry, is

desirous of associating itself with other groups who have similar conservation objectives;

"NOW, THEREFORE, BE IT RESOLVED by the NATIONAL FISHERIES INSTITUTE at its 13th Annual Convention in San Francisco, California, on April 23, 1958, that:

- "(1) The policy of the National Fisheries Institute is to do everything it can to foster the conservation and wise use of the natural resources of the United States, particularly the fishery resource itself, and the water and related land needed to support the fishery resource and the wildlife resource of the Nation; and
- "(2) The National Fisheries Institute declares the harmony of its conservation objectives with those of other similar organizations who are working to advance sound conservation of water and land with the objective, among others, of preserving and improving habitat for the fish and wildlife resources of the United States; and
- "(3) The Institute desires to cooperate with other organizations in the development and support of conservation legislation and conservation programs at both the National and State levels which are in accord with this conservation policy statement."



North Atlantic Fisheries Exploration and Gear Research

HARD-SHELL AND SURF CLAM EXPLORATION BY M/V "SUNAPEE:" The M/V Sunapee, under charter to the U. S. Bureau of Commercial Fisheries, began operations on June 2, 1958, to conduct a survey of Nantucket Sound and adjacent waters for the purpose of evaluating the commercial potential of hard-shell and surf clams, as recommended by the Atlantic States Marine Fisheries Commission.

The first month of exploration was hampered by unusually bad weather, limiting operations to 68 tows in the Nantucket Sound area; only 5 tows showed commercial concentrations. There were 4 tows of one-hour duration made $1\frac{1}{2}$ miles SE. $\frac{1}{4}$ S. from Tuckernuck Shoal Buoy in 36-41 feet of water on a mixture of mud and sand. These 4 tows yielded an average catch of 7-8 bushels (85 pounds shell to the bushel) of hard clams (Venus mercenaria) with a meat yield of about 8.5 pounds per bushel.

The other area having a significant commercial concentration was located $1\frac{1}{2}$ miles SW. and S. from Great Point, Nantucket Island, in 41 feet of water. The bottom was a mixture of mud, sand, and slipper shell. In a 20-minute tow, 11 bushels of hard-shell clams were dredged. The remainder of the area surveyed showed nothing of commercial value. The Great Point area, which showed the best yields, lies within the boundaries governed by the Town of Nantucket. There have been no

indications of new spat being set in the area, and determinations, so far, showed that the hard-shell clams taken to date are from the 15-20 year-class.

Observations made of the gear showed that winds of over 15-18 miles and strong tides affect the dredging unfavorably, making it impossible to fish under those conditions. It was planned to continue exploration through August, and it was expected that with better weather, the number of stations occupied during July would be increased.

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HARD-SHELL AND SURF CLAM EXPLORATIONS CONTINUED (M/V Sunapee): The Nantucket Sound phase of a jet-dredging survey for hard clams (Venus mercenaria) was completed on August 1, 1958, by the U. S. Bureau of Commercial Fisheries chartered vessel Sunapee. The survey was conducted on a grid basis by locating stations one mile apart on an east-west line and one-half mile on a north-south line. There were two phases of the survey.

The first phase was conducted during July south of $41^{\circ}25'$ N. latitude, bounded by Nantucket Island on the east and Cape Poge, Martha's Vineyard, on the west. A total of 86 stations were completed in this area with only 6 having indications of commercial value. Of these 6 stations, one was northeast of Edgartown with a depth of 36 feet on a mixture of mud and sand; four were $1\frac{1}{4}$ -2 miles to the south and east of Tuckernuck Shoal Buoy on a mixture of mud and sand; and the other one was 2 miles SSW. from Great Point, in 41 feet of water on a brown sand bottom. The Great Point and Edgartown tows were within the township areas. A total of 76 bushels of hard clams were taken in these areas. Meat-yield tests showed 50 pounds of shell to 4 pounds 14 ounces of meat to be the average for the area. Surface water temperatures showed a high of 67° F. and a low of 62° F. Tests were made for clams of smaller than commercial size, without success.

During the second phase, a total of 300 stations were covered of which 107 could not be fished due to rough bottom conditions. Operations were conducted in the area bounded by $70^{\circ}04'$ W. - $70^{\circ}38'38''$ W. longitude and $41^{\circ}25'$ N. - $41^{\circ}31'38''$ N. latitude. The entire channel from Vineyard Sound to Pollock Rip was found to be unfit for jet-dredging operations because of strong tides, rocks, and sand ridges. The bottom from Bishops and Clerks, west to Wreck Shoal Buoy 16, was found to be composed primarily of sand and rocks. The Succonesset area to Nobska Point was also rocky. From Horseshoe Shoal on the east, including L'Hommedieu Shoal, to Bell Buoy 18 on the west, strong tides, rocks, and sand ridges made this area also unfit for fishing. Where it was possible to tow, no indications of hard clams were found.

The only area that showed a commercial potential during operations of the second phase, was $1\frac{1}{2}$ miles NNW., 4 miles NNE., and 3 miles ENE. from Half Moon Shoal buoy on a bottom of mud and sand in depths of 31-50 feet of water. Meat-yield tests, conducted from several stations, showed 40 pounds of shell to $6\frac{1}{2}$ pounds of meat. Small clams were sought, but, as in the other area, none were found. According to all indications, the hard clams caught were from the same set of a few years ago.

The survey will continue on August 4, 1958, in the area south of Martha's Vineyard and Nantucket Island. The purpose will be to explore this area for concentrations of surf clams and to evaluate their commercial potential. A final progress report, covering this phase of the project, will be published after the completion of the Sunapee charter on August 30, 1958.

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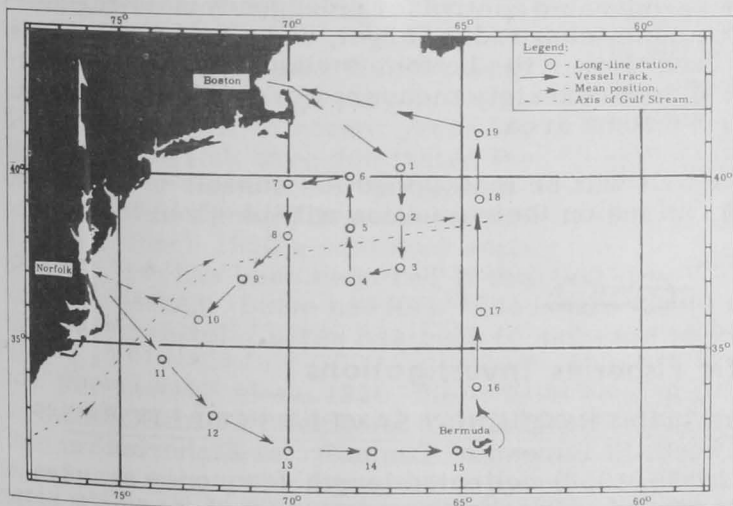
TUNA FISHING EXPLORATIONS CONTINUED IN WESTERN NORTH ATLANTIC (M/V Delaware Cruises 58-3 and 58-4): Significant concentrations of yellowfin tuna (Thunnus albacares) and big-eyed tuna (Thunnus obesus) were found during the second tuna long-line exploratory cruise of the 1958 season made by the U. S. Bureau of Commercial Fisheries exploratory fishing vessel Delaware, July 8-August 4. The cruise covered 19 stations in an area ranging from south and east of Georges Bank, west to off the coast of Virginia and east to the Bermuda area.

As in previous cruises, the most productive area was south of Georges Bank. Three of the stations in this area produced by weight, 65.2 percent of all yellowfin tuna and 41.8 percent of the total quantity of fish landed during this cruise. Two of the stations were located north of the mean axis of the Gulf Stream and the other station was located to the south. The surface water temperature was 75.0°-79.5° F. Yellowfin tuna were taken at all of the 19 stations, except that for 5 stations the surface water temperatures were 70.5°-83.0° F. The largest numbers of fish occurred in temperatures between 75.0° F. and 79.5° F.



The Bureau of Commercial Fisheries exploratory fishing vessel Delaware.

All of the bluefin tuna (Thunnus thynnus) caught on this cruise were taken at 2 stations. Both of these stations were located south of Georges Bank along the 1,000-fathom line. Surface water temperatures were 60.0° F. and 64.0° F., respectively. The presence of bluefin in this temperature range closely agrees with the findings of previous cruises. The aggregate weight of bluefin was 1,030 pounds, a small amount in contrast to the large quantities previously taken at the same locations during other months of the year. This may be due to the inshore movement of bluefin tuna during this season.



M/V Delaware cruise 58-3 (July 8-August 4, 1958).

The same stations that yielded bluefin also produced 2,950 pounds of big-eyed tuna. This is a heavier concentration than previously encountered and may represent the vanguard of the big-eyed population during the seasonal movement.

The first blackfin tuna (Thunnus atlanticus) caught during the North Atlantic offshore explorations was at a station located ESE. of Cape Hatteras. A second specimen was found in the stomach of a large blue marlin taken at the same station. The surface water temperature was 83.0° F.

At 7 stations, 15 albacore tuna (Thunnus alalunga), having an aggregate weight of 750 pounds, were taken as singles except for 3 stations which yielded 4, 5, and 2 fish respectively. The surface water temperatures at these three stations were 76.5° F., 64.0° F., and 74.0° F., respectively. The temperatures, at the other four stations were all below 77.0° F. and above 69.0° F., except for 1 station which had a temperature of 83.0° F.

Incidental species taken during the long-line operations consisted of 7 blue marlin (Makaira ampla) 17 white marlin (Makaira albida), 19 blue sharks (Prionace glauca), 6 white tip sharks (Pterolaminopa longimanus), 16 lancetfish (Alepisurus ferox), 4 wahoo (Acanthocybium petus), 6 dolphin (Coryphaena hippurus), 1 skipjack bonito (Euthynnus pelamis), 1 opah (Lampris regius), 2 silk sharks (Eulamia floridan), 1 swordfish (Xiphias gladius).

Commercial-type long-line gear of nylon construction was used at all stations. On the first ten stations, frozen herring (Clupea harengus) was used exclusively for bait. The common butterfish (Poronotus triacanthus) was used on one station. At 8 stations both butterfish and herring were used with no appreciable difference in results.

After completion of fishing on the first 10 stations, 750 pounds of tuna were unloaded in Norfolk, Va., for shipment to the Washington, D. C., area.

In cooperation with the Woods Hole Oceanographic Institution and Virginia Fisheries Laboratory, bathythermograph casts were made and surface temperatures and other oceanographic data, morphometric data, and biological material were taken. Night lighting was conducted at each station.

The Delaware was scheduled to depart from East Boston on August 25, 1958, for a combined 5-day safety and gear research cruise in the Gulf of Maine, Georges Bank area.

New equipment to be tested includes an improved type winch head for use in hooking up the trawl wires, a pilothouse-operated control for emergency main engine stops, a distance reception test of an aluminum radar target, and a new plastic-type trawl float. Also distances to be covered over the bottom during trawling tows, employing standard #41 otter trawl, will be accurately measured over a buoyed course in the South Channel-Western Georges Bank area.

During this cruise a special lookout will be maintained for schools of small bluefin tuna and if they are sighted, advice on their position will be given the commercial fishing industry.



North Atlantic Fisheries Investigations

SCALLOPS TAGGED AND LENGTH-FREQUENCY SAMPLES COLLECTED (M/V Albatross III Cruise 113): The U. S. Bureau of Commercial Fisheries research vessel Albatross III (June 19-26, 1958) collected length-frequency samples and tagged sea scallops on Georges Bank, and took 345 underwater photographs of the bottom at 7 different locations.

Fifty-six scallop dredge hauls were made for length-frequency and length-weight data; and 7,654 scallops were tagged and dropped on 13 different locations. A bathythermograph section was taken from Great Round Shoal along the southern edge of Georges Bank to the Southeast Part and up to the Northeast Peak.

WHITING TAGGED AND LENGTH FREQUENCY SAMPLES COLLECTED (M/V Albatross III Cruise 114): Fifty-eight tows were made on Georges Bank and along the inshore waters of the New England coast to collect whiting (silver hake) for tagging. Bathythermographs were taken regularly after each tow during this cruise of the U. S. Bureau of Commercial Fisheries research vessel Albatross III (completed July 16, 1958).

A total of 2,500 whiting were tagged and released in 6 different locations, including Cultivator Shoals, Ipswich Bay, Cape Cod Bay, offshore Cape Cod, and SE. No Mans. An additional 1,200 fish were measured, and haddock and yellowtail flounder samples were brought back to the laboratory for detailed study.

* * * * *

HADDOCK FISHERY FUTURE TO BE ASSESSED BY M/V "ALBATROSS III:"
So as to obtain critical information on the abundance of baby haddock upon which the success of the commercial fishery will depend in the next few years, the U. S. Bureau of Commercial Fisheries research vessel Albatross III in August was preparing for an extended fall cruise. Catches of haddock since June have fallen off sharply due to a scarcity of young fish. The Albatross III cruises will attempt to measure the extent of this scarcity.



Service's research vessel M/V Albatross III.

The stocks of Georges Bank haddock have been fished down to the point where the catches depend upon large numbers of comparatively small fish. Before 1950, the landings of large haddock (over 2.5 pounds) always exceeded the landings of scrod haddock (less than 2.5 pounds). Since 1950, scrod has exceeded large in the landings.

In terms of age, the fishery was once supported in large part by fish 1.5-9 years old, but in recent years 2- to 4-year-old fish have dominated the catches. The depletion of large fish has placed the fishery in a precarious position. Since 1950 a continual supply of small fish has been required to maintain the catches. Since haddock broods are frequently failures, the abundance of the precommercial sizes has been of extreme interest to the fishing industry.

Fortunately, since 1950, there have been some extraordinarily large year broods so that the catches have been well maintained, although composed of smaller fish than in former years. The alternate year broods: 1948, 1950, 1952, and 1954 have been large ones. The intervening year broods have been failures. It has been realized for many years that two failures in succession would spell poor fishing for a year at least.

There are now indications that such a condition has occurred. The first reliable measure of the abundance of an incoming brood or year class is obtained when the fish are two years old. If the brood is a large one they begin showing up in the commercial landings as small scrod in June and July of their second year of life.

Last year these small scrod failed to appear which means that the 1955 year-class is a small one. This is in keeping with the alternation that has occurred in recent years. If the alternation continues, the 1956 year-class should be a big one. However, evidence is now appearing that this is not so. It is already late August and the small scrod are not being landed in quantity. This has had a serious effect on the landings during these summer months. For the period July 1 to August 15 Boston landings of haddock dropped from 14 million pounds in 1957 to 10 million pounds in 1958. The abundance of fish is expressed by the average catch per trip. This index dropped from 82,000 pounds in 1957 to 55,000 pounds in 1958 for the above period.

There is one possible hope for the immediate future. The 1956 year-class may simply be abnormally late in arriving. If it appears in September, all will be well for another year or two. If it does not appear, if this year-class is a failure, the abundance of commercial sizes of haddock on Georges Bank will be abnormally low for at least a year to come.

In this case interest turns to the next two year-classes that are present on the banks, the one-year-olds, spawned last year, and the young-of-the-year which were spawned in March of this year and which are just now settling to the bottom to take up their permanent habit as bottom feeders. The abundance of these two year-classes is of the greatest importance to the haddock fishery during the next few years.

Fish of last year's spawn are due to enter the fishery next year. Albatross III cruises of last year failed to turn up many of these fish. They are not expected to contribute much to the fishery. This scarcity focuses even greater attention on the brood to follow, namely, the current one of 1958.

There are signs that this current year brood is a large one. Fish of about four inches long have been reported in cod and pollock stomachs in large numbers, usually a sure sign of a big brood. In July when the Albatross III was fishing at mid-depth for ocean perch fry she encountered numerous young haddock where few had been found last year.

The fall cruises will give us a better estimate of the abundance of this critical year-class as well as additional information on the abundance of the one-year-olds. The vessel will survey the entire area of Georges Bank at all depths where small fish occur. She was scheduled to leave on September 22, when all of the new year-class is expected to have reached the bottom, and will work until October 24. The results of her survey will be announced upon her return.

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HADDOCK SAMPLES COLLECTED FOR ECOLOGICAL STUDIES (M/V Silver Mink): During a one-day cruise (June 8, 1958), the U. S. Bureau of Commercial Fisheries chartered vessel Silver Mink made observations and collected data for the haddock ecology study. The area covered by the cruise included the Highland Grounds north-northeast of Cape Cod Light in 29-32 fathoms. The area fished was $\frac{1}{2}$ mile wide (east to west) and $5\frac{1}{2}$ miles long (north to south). Three tows were made with an otter trawl having a $1\frac{1}{2}$ inch mesh cod end. One bathythermograph lowering was made. All species were identified and enumerated in one sample tow and the important species were measured. A sample of dabs was collected for age and growth studies.

A total of 4,628 haddock were caught from which a sample of 1,064 were measured and scale samples were obtained from 91 male, 86 female, and 10 unsexed haddock. A total of 91 haddock was tagged.

In a sample of 48 male and 50 female haddock, fish weight, liver weight, gonad weight and state of development, and drumming muscle length, weight and color were recorded. Scales, fin rays, and stomach contents were collected.

Haddock were most abundant in the catch, with over 75 percent of them one-year-olds; ocean pout, longhorn sculpin, and whiting were next in order of abundance.

About 5 percent of the mature female haddock examined had running ripe eggs in the ovaries; the rest were completely spawned out. A few female whiting were observed with ripening ovaries.

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HADDOCK ECOLOGY STUDIES CONTINUED (M/V Shirley and Roland): Observations and the collection of data for the haddock ecology study were conducted by the U. S. Bureau of Commercial Fisheries chartered vessel Shirley and Roland during two cruises--on July 12 and August 9, 1958--in an area NNE. of Cape Cod Light, Mass.

During the July 12 cruise, two tows were made in depths of 56-58 fathoms, with an otter trawl having a $1\frac{1}{2}$ -inch mesh cod-end liner. The area fished was 4 miles wide (east to west) and $1\frac{1}{2}$ miles long (north to south). The first tow was aborted when it hung up after 5 minutes of towing. The second tow was one hour long but the net was badly torn when hauled back and very few fish were retained in the cod end. One bathythermograph lowering was made. No haddock were obtained for the purposes of the ecology study and, because of the extensive damage to the net, the cruise was terminated.

The August 9 cruise was conducted in depths of 32-59 fathoms. Five tows were made with an otter trawl having a $1\frac{1}{2}$ -inch mesh cod-end liner. The area fished was 5 miles wide (east to west) and $4\frac{1}{2}$ miles long (north to south). A total of 95 haddock were caught and measured.

In a sample of 30 male and 23 female haddock, fish weight, liver weight, gonad weight and state of development, and drumming muscle length, weight, and color were recorded. Also, scales, fin rays, and stomach contents were collected. No haddock were tagged, because of the high mortality of the fish in the holding tank on deck. A strong thermocline occurred at this station and it is presumed the fish died from the shock of the rapid temperature change to which they were subjected during haulback of the net.

All species were identified and enumerated in one sample tow and the important species were measured. Red hake were most abundant in the catch. Next in order of abundance were whiting, dabs, and skates. Haddock were extremely scarce. Some whiting and red hake with ripe ovaries were observed.

A sample of dabs was collected for age and growth studies. Two bathythermograph lowerings were made.

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LIFE HISTORY STUDIES OF INDUSTRIAL FISH AND SCALLOPS (M/V Jacquelyn Cruise July 18): During a one-day cruise (July 18, 1958), the U. S. Bureau of Commercial Fisheries chartered vessel Jacquelyn collected samples at the regular fishing and scallop stations off Block Island. Length frequencies were taken of many species of fish. Samples of scallops, butterfish, and yellowtail were brought back to the Bureau's Woods Hole Laboratory for study. There was a marked decrease in numbers of eelpouts (Macrozoarces anguillar). Fluke have also moved off stations in shoaler water.

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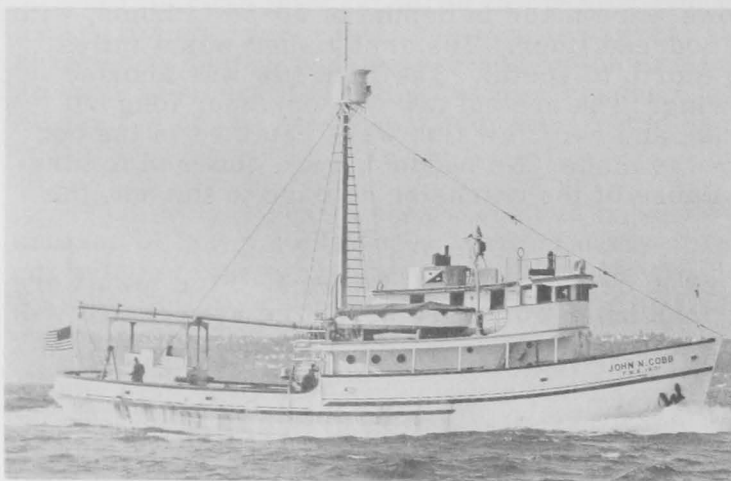
LIFE HISTORY STUDIES OF FISH AND SCALLOPS (M/V Jacquelyn Cruise August 18): Selected fish and scallop stations off Block Island were sampled on August 18 during a cruise by the U. S. Bureau of Commercial Fisheries chartered vessel Jacquelyn, operating out of Point Judith, R. I. Collections were made of scallops and other invertebrates.

Samples of scallops, red hake, yellowtail, butterfish, scup, blackback, and fluke were brought back to Woods Hole for study. Two dozen live gravid scallops were brought back for experimentation.



North Pacific Exploratory Fishery Program

SHRIMP AND SCALLOP SURVEY STARTED IN ALASKA (M/V John N. Cobb Cruise 39): An 8-week exploratory shrimp cruise in Alaska by the U. S. Bureau of Commercial Fisheries vessel John N. Cobb was scheduled to begin on July 14, 1958.



Service's research vessel M/V John N. Cobb.

Explorations were to be conducted in the waters adjacent to Kodiak Island and in lower Cook Inlet. From Seattle, the vessel was to proceed to Seldovia on Kenai Peninsula and commence fishing activities in nearby waters. Work was to extend from this area to northeastern Kodiak Island.

Objectives of the investigations will be to determine the distribution, abundance, and species of shrimp inhabiting this region. Concurrent with the shrimp studies, an attempt was to be made to locate commercial concentrations of the large Alaska scallop.

The John N. Cobb was to use a variety of gear to carry out the studies: Gulf of Mexico flat and semi-balloon trawls, beam trawls, traps, and a scallop dredge.

The adoption and success of the shrimp peeling machine on the west coast of the United States has developed renewed interest as to the possibilities of developing a large shrimp fishery in the bays and ocean waters off Alaska. Several shrimp peeling machines are now in operation in Alaska and more will be put into use this year.



Oysters

USE OF PLASTICS FOR COLLECTING OYSTER SET: One of the problems facing the oyster cultivators of northern waters during the last two decades is the difficulty of obtaining sufficient quantities of oyster shells to be planted as cultch. The Milford (Conn.) Marine Biological Laboratory of the U. S. Bureau of Commercial Fisheries realized the existence of this problem and experimented with different materials that could be used as set collectors. The qualities that were sought in these materials were lack of toxicity to oyster larvae and spat, low cost, ease of handling, and versatile usage.

Early experiments conducted during the war and soon after, used some of the plastics available at that time and also materials used in insulating buildings. About 1950 the first efforts were made, under laboratory conditions, to secure oyster set on plastic films and screens. Most of these experiments were not too successful because the materials used were probably toxic enough to repel the larvae or cause their mortality. Nevertheless, the idea of using plastics continued to appeal to us and, eventually, in a series of laboratory experiments we found that several plastics, especially the polyethylenes, were fully suitable for the attachment of oyster larvae and, apparently, normal growth of young spat. Collectors made of the same material and placed in natural waters also caught set. Oysters attached to polyethylene collectors have been demonstrated at several meetings of biologists during the last few years.



Oyster set on plastic materials at Milford Marine Biological Laboratory.

Work on the development of various types of plastic collectors is being continued at our Laboratory. We visualize collectors of various shapes and sizes adaptable to different sets of conditions. For example, in deep open waters, such as Long Island Sound, collectors resembling a spiral, three or four feet in diameter, perhaps several hundred feet long and anchored at the ends, may be used. Large areas of such collectors would not be touching bottom, a condition which will protect the recently set oysters from silting and, at the same time, from some of their enemies. These collectors will not interfere with navigation, and because of the depth they may be relatively safe during storms.

In ponds or well-protected bodies of water, sheets or strips of plastic of required thicknesses will hang vertically, utilizing, if necessary, the entire stratum of the water in which setting of oyster larvae is possible. The collectors may be suspended from regular floats, or so manufactured that their upper portions will contain large numbers of air bubbles acting like floats, while the bottom will be weighted down by some heavy material, such as sand. These two devices can maintain the plastic sheet collectors in a vertical position and, at the same time, off the bottom so as to protect the recently-set oysters from such enemies as starfish, drills, crabs, etc.

Before the ideal type of plastic collector is developed many improvements are needed. At present, we find that the surfaces of most polyethylene films are too smooth and this condition causes the oyster set to peel off the collectors as soon as it reaches the size of $\frac{1}{8}$ -inch or somewhat larger. By making the surfaces coarser or incorporating in them, if possible, material like sand or fine particles of oyster shells, attachment of spat to the collectors may be more secure.

Another important aspect in the development of collectors is to incorporate in them or adsorb to their surface certain chemical compounds that will repel some undesirable aquatic forms, such as mussels, barnacles, tunicates, etc., thus preventing fouling. The same principle may also help to repel some of the predators, such as worms of the genus *Stylochus*, which usually set at the same time as oysters and soon begin to attack them. Some progress has already been made in this direction.

The cost of plastic collectors, per foot of the surfaces available for setting of oysters, may compare favorably with that of oyster shells. Some of the plastic films found by us suitable for the collection of set are sold for about one cent per

square foot if bought in large quantities. Considering that both sides of this material will be used in getting set, the actual cost will be less than one cent per square foot of collecting surface.

--V. L. Loosanoff, Director,
Marine Biological Laboratory,
U. S. Bureau of Commercial Fisheries,
Milford, Conn.

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SPRING FRESHETS KILLED VIRGINIA'S JAMES RIVER SEED: Substantial kills of seed oysters in the upper third of Virginia's James River seed area followed unusually heavy freshets this spring, according to a report by an oyster biologist of the Virginia Fisheries Laboratory made to oystermen attending the 50th Annual Convention of the Oyster Growers and Dealers Association and the Oyster Institute of North America in Baltimore, Md., July 20-24, 1958.

"About 90 percent of the oysters on Deepwater Shoal, the uppermost bar in the James, were killed," the biologist reported. On other bars in the upper seed area, about 30 percent died. Fortunately, bars lower down, like Wreck Shoal, were not affected. Effects of these kills will be noted by tongers when the seed-oyster season opens in October.

Oysters brought to the Virginia Laboratory from the affected area and placed in running fresh water began dying after 17 days, but some remained alive 62 days. It is not known how long they had been subjected to fresh water before they were placed in running water. Laboratory scientists have determined that oysters which are gradually subjected to fresh water are able to survive better than those suddenly flooded.

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INDUSTRY PROBLEMS SUBJECT OF REMARKS AT OYSTER INSTITUTE OF NORTH AMERICA MEETING: Excerpts from the remarks by Assistant Secretary of the Interior Ross Leffler before the Oyster Institute of North America at Baltimore, Md., on July 21, 1958, follow:

". . . Like many other fisheries today, you are faced with problems. Some of the problems are the result of man's doings. Had we had the technical know-how of today during the developmental periods of our Nation's growth, perhaps our situation would be different.

"But we didn't have that know-how and now we have problems. To many of us the magnitude of these trouble areas seems overwhelming. But, gentlemen, I am confident that there are none which we can't lick by working together. If we can join our forces--the industry, the States, and the Federal Government--in a well-organized team, I see no reason why the oyster industry will not assume its rightful place in our fisheries economy. To me, it looks like a bright future because we already have launched the kind of a partnership effort which is necessary. I am also encouraged by the commendable attitude of the oyster industry. In the face of all the difficulties being encountered, the industry is not sitting on its hands waiting for its problems to be solved but is striving on its own to get the answers. We're happy to be partners with that kind of courageous fighters.

"Let us quickly review the industry's problems--the age-old predator problem is still with us, the

problems of man-made influences, changing environment, pollution--and increased production costs are also with us.

"The Bureau of Commercial Fisheries is keenly aware of your problems and is forging ahead as fast as time and funds permit to help lick your problems. But, we are primarily a fact-finding organization, an organization which can help you through your industry and State agencies to meet the problems head-on.

"I know from an on-the-spot investigation that the Long Island Sound situation is bad. With starfish increasing some ten times in a single year and ruining up to 90 percent of the oyster crop in some beds, you oystermen are no doubt having a rough time of it. Incidentally, you should be commended on the fine efforts you have been putting forth to control these predators on the private oyster grounds. Unfortunately, starfish flourish on natural bottoms as well as on your managed grounds.

"Under ordinary conditions, the common control methods can do the job. But the present problem is so great that these methods can't do the job, particularly when no control is applied to the public beds. As you know, legislation has been introduced

eed which authorizes funds with which to carry out an extensive emergency starfish eradication program. This program would not only protect the market oysters but would also protect the extensive seed beds so vital to production in New York, Connecticut, Massachusetts and Rhode Island.

"Of course you want to know what we are doing on this and other problems. With Saltonstall-Kennedy funds, our researchers are engaged in an extensive search for better predator control methods. Our people are screening hundreds of chemicals to see if any might be useful as selective poisons for starfish. As most of you know, we have had great success in the Great Lakes with selective poisons for sea lamprey. We feel that this chemical program is going to provide us with a very valuable tool to solve many fisheries problems.

"I would like now to mention also what we are doing in the way of research on that other common predator, the oyster drill. Most of you are aware that the copper barrier studies have been successful. Our biologists are now actively developing low portable fences containing copper and testing them under natural field conditions so that they can recommend to you the most efficient and economical types. We feel this advancement in our knowledge of drill control is a large step forward.

"Also we have contracted with several universities, State fishery laboratories, and other organizations for research into special studies on shellfish problems. I am pleased to report that all of our contract work is coming along exceedingly well and the results we hope can be applied in the very near future to achieve more efficient predator control and better oyster production.

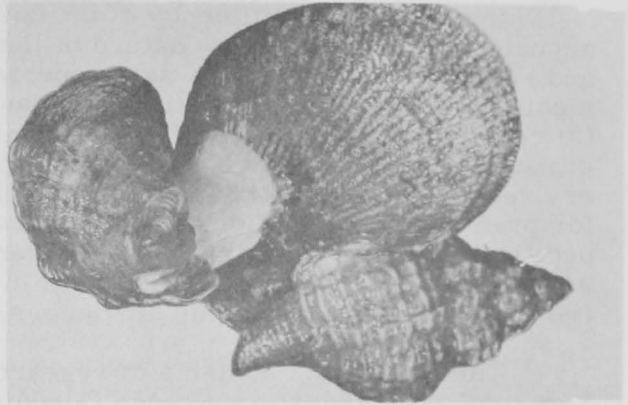
"We are particularly proud of the work which is being accomplished at our Shellfish Laboratory at Milford, Conn. Our researchers there are attacking the problem of increasing the production of seed oysters. The shortage of seed oysters from Chesapeake Bay northward is, as I understand it, one of your most serious problems and has been in existence around 1945. The biologists at the Milford laboratory have already developed the basic techniques of artificial propagation of seed oysters. At the present time they are directing their efforts toward making these methods commercially applicable. We feel confident that through artificial propagation we will also be able to selectively breed the most desirable oysters so that the industry can eventually produce nothing but a top-quality product.

"The destruction of seed beds in recent years by environmental changes from industrialization filling, dredging, and pollution has been a very serious problem. For that reason, I'm convinced we are striking right at the heart of our difficulties when we expand our efforts to restore the seed beds. You

will reap real benefits when those efforts begin to pay off.

"As another assistance to your industry, we have recently sent personnel to Europe and Japan to study their methods of oyster and fish farming. We will make those findings available to you at an early date.

"I am sure also that all of you here will be very pleased to know that the Interior Appropriations



Oyster drills attacking mussels.

Bill provides money for the construction of a new shellfish laboratory in the Chesapeake Bay area. Our people are now investigating possible sites and we will shortly select a location so that the construction can get under way as soon as possible. We anticipate the construction of this laboratory will provide a place for expansion of shellfish research so that we will be in a better position to tackle the problems of the industry.

"... We are all aware of the continued problems you encounter in terms of the amounts of "free liquor" in your product and of the large variations in its total solids content. Our technologists have studied these problems and only last year their expert testimony was requested on these matters in a Federal court case. We are presently engaged in developing plans for a three-way study of these problems, plans in which industry, the Department and the Food and Drug Administration will cooperate. I am sure that this will be a fruitful approach.

"In recent years, much study has been given to the well-known problems encountered when one wishes to market southern oysters in any but the fresh form. We haven't the whole solution, as yet, but enough is now known to justify continuation of the work in our Service laboratories on a semicommercial basis. We are certain that shortly you will be able to market these oysters in many other forms than those to which you have been accustomed and which have served to restrict the growth of your industry . . ."

Pacific Oceanic Fishery Investigations

ANNUAL REPORT FOR FISCAL YEAR 1958: During the year (July 1, 1957-June 30, 1958) and the preceding fiscal year the program of the Bureau of Commercial Fisheries Pacific Oceanic Fishery Investigations (POFI) has been in transition, from the exploration of high-seas fishery resources of the United States territories and island possessions in the tropical and subtropical Pacific Ocean to increasing the efficiency of utilization of these resources.

Increasing the efficiency of utilization may conveniently be considered in three aspects, which are: (1) the nature of the resource, its magnitude, size composition, and relation to stocks of the same species in adjacent areas; (2) the seasonal movements and migration in relation to oceanographic features of the environment; and (3) reactions of the fish to gear and related circumstances accompanying fishing operations. A knowledge of the first is a prerequisite for properly evaluating a fishery resource in terms of its commercial worth. A knowledge of the second is needed for predicting the location of schools of fish and so enable the fisherman to find expeditiously areas of commercial abundance of fish. A knowledge of the third would seem to be essential for any increase in the efficiency of the means of capturing fish and of improving fishing appliances.

The immediate subjects of research were concerned, however, with the surface tuna of northeastern French Oceania (Marquesas Islands), skipjack tuna in the Hawaiian waters, and the albacore of the northeastern Pacific. The investigation of the tuna in each of these areas represented, in one or more aspects, an attempt to reach the goals previously mentioned. Several supporting projects which relate not solely to one of the three research subjects listed are described separately, since in one form or another they contributed to all.

Equatorial Tuna Program: During September 1956, POFI initiated a survey program primarily planned to determine the geographical and temporal variations in abundance of the tuna, particularly the surface schools of skipjack, in the waters of northeastern French Oceania. Various oceanographic and biological observations were included. This program, consisting of 9 cruises to the waters surrounding the Marquesas Islands, was completed on June 23, 1958, with the return of the research vessel Hugh M. Smith to Honolulu. Analyses of the resulting data are presently under way with a scheduled completion date of June 1958. A preliminary review of these analyses reveals:

1. The abundance of the surface tuna schools reaches its peak during January-March, the Marquesan (southern hemisphere) summer. A standardized "inshore" survey path around the Marquesas Islands at an average distance of approximately 15 miles from land, was followed at least once each cruise for a total of 9 such surveys. An "offshore" survey pattern, extending 225 miles seaward, was included in the program commencing with the November 1957 cruise. The rate of sightings of the surface schools for each survey is shown in table 1.

A study of the locale of the surface school sightings expressed in table 1 has not revealed any areas along either the inshore or offshore paths wherein concentrations of schools consistently occurred. Most of the surface tuna schools sighted were skipjack. Some yellowfin, which were usually found mixed in the schools with the skipjack, were caught. The general behavior of the tuna schools in the Marquesas area can be described as "wild" and fast-moving. The biting response to live-bait fish-

ing techniques was not particularly favorable. Of 1,146 skipjack measured, 88 percent were under 10 pounds, with most 4-6 pounds. Somewhat further south, in the waters surrounding the Tuamotus, larger fish were relatively more abundant with

Table 1 - Rate of Sightings of Surface Tuna Schools off the Marquesas Islands

Survey No.	Dates	Sighting Rate Per 10-Mile Run
Inshore		
1	September 7-14, 1956	0.7
2	January 25-30, 1957	1.8
3	February 23-29, 1957	1.7
4	October 14-21, 1957	0.6
5	November 24-30, 1957	0.8
6	January 18-25, 1958	1.3
7	February 27-March 5, 1958	1.8
8	April 11-19, 1958	1.0
9	June 1-10, 1958	1.2
Offshore		
1	October 24-December 6, 1957	0.3
2	January 28-February 11, 1958	0.8
3	March 26-April 8, 1958	0.6
4	May 15-29, 1958	0.6

skipjack over 10 pounds in weight comprising 43 percent of the samples. The biting response of the schools encountered during surveys in the Tuamotus was much more favorable than for those near the Marquesas.

A total of 4,461 skipjack and yellowfin were tagged using the POFI D-2 dart tag. To date, there have been no reported recoveries of these tagged fish. The lack of recoveries of these tagged Marquesan tuna is of interest when compared to the recoveries of tagged tuna in Hawaiian waters, where about 9 percent of all tagged fish have been recovered. The lack of recoveries in the Marquesas is of little significance, but the failure to make recoveries in other fisheries is, for it suggests the

"Marquesan population" is not being fished at present and thus represents an unutilized resource.

2. The bait used for live-bait fishing in the waters of French Oceania was the Marquesan sardine (*Harengula vittata*). In various bays of the Marquesas Islands, the availability of these fish to baiting techniques showed considerable variability. Ecological and biological observations accompanied each baiting operation. The results to date suggest that the supply of these sardines, at least in the shallower areas of the bays, are inadequate to support live-bait fishing by a tuna clipper on a commercial scale.

3. Preliminary results from three of the supporting biological studies--skipjack gonad, tuna larvae, and tuna food--are available. The mean diameters of the most advanced group of eggs from skipjack ovaries collected in Marquesan waters ranged from 0.37 mm. to 0.74 mm. Over 90 percent of the Marquesan skipjack examined had ovaries in which the most advanced group of eggs had mean diameters greater than 0.5 mm.

Although only one fully ripe skipjack has been caught, the distribution of larvae caught in plankton tows suggest rather extensive spawning in the area. For example, on an offshore survey conducted during the October-December cruise of the research vessel *Charles H. Gilbert*, the numbers of skipjack larvae taken (a mean of 2.0 larvae under a 10 m² area of sea surface in both the offshore and inshore sectors) indicate, on the average, that these larvae were distributed homogeneously throughout the area of the survey. The sightings of bird flocks and tuna schools, on the contrary, were much more frequent in the immediate vicinity of the Marquesas than farther offshore, with a tuna school sighting rate per 10-mile run of 0.5 along the inshore sector and 0.1 along the outer.

To date, stomachs from 370 skipjack caught in Marquesan waters have been examined, revealing a preponderance of fishes in their diet. Percentage occurrences of the various food items were as follows: fishes 59.9 percent, crustaceans 33.4 percent, molluscs 6.4 percent, and tunicates less than 1 percent. Of the food fishes, 27 families have been identified and, of these, 19 are primarily families of inshore or neritic forms.

Mid-Ocean Skipjack Program: THE FISHERY: An estimated catch of 3 million pounds in the Hawaiian skipjack fishery for the first 6 months of 1958 provides little hope of a profitable year for the industry. During the first 6 months of 1957 the catch was 3.1 million pounds and the year turned out to be the poorest (6.1 million pounds for the calendar year 1957) since 1948 and the war years.

The poor fishing during 1957 and the first half of 1958 have, however, provided unexpected aid in relating catch statistics to environmental changes. The theory that fluctuations in the fishery can be rationalized on the basis of changes in the environment has also received strong support from oceanographic and monitoring investigations.

HAWAIIAN OCEANOGRAPHY IN RELATION TO THE FISHERY: The work on the atlas of Hawaiian oceanography, which is essentially a climatic study of the ocean, has progressed far enough to indicate that the islands are bathed principally by either

downstream Kuroshio Current type of water or downstream California Current type of water. The former tends to predominate throughout the year except for the spring and early summer months when the latter seems to intensify sufficiently to spread into the high-islands region. In other words, the Hawaiian Islands are so located that the boundary between these two systems moves northward into the islands region in spring and then retreats southward at the end of summer. The seasonal migration of this boundary depends upon the relative strength of the two systems and at times may fail to move far enough north to traverse the high-islands region.

In connection with this work we are studying the rates of change of temperature at selected monitoring stations. Certain rates appear to be a characteristic feature of the locality so that deviations from the "characteristic" curves can be interpreted in terms of the environmental processes described above. This feature promises to become an important tool in interpreting data from the cooperative temperature and salinity sampling programs described later. In the vicinity of the Hawaiian Islands the boundary between the two systems is well defined by a relatively sharp salinity gradient. Thus in addition to the "characteristic" temperature curves, the salinity shows promise of being a very sensitive indicator of environmental changes.

With this oceanographic picture in mind, it now appears that the skipjack population is concentrated in the boundary between the downstream California Current type of water and the downstream Kuroshio Current type of water. The indices mentioned show that the oceanographic system was displaced southward during 1957 and the first 6 months of 1958 so that the boundary between the two types of water did not reach the islands. This may provide a basis for understanding the failure of the Hawaiian skipjack fishery during these two seasons. Admittedly, an examination of these oceanographic features for a series of "good" seasons would provide a better background for interpretation of the relations between skipjack availability and oceanographic features.

LOCAL ENVIRONMENTAL STUDIES: An intensive study of seasonal variation in Hawaiian zooplankton was completed. The study showed that if the island area is considered as a whole there is little seasonal variation in the amount of zooplankton. If the area is subdivided into windward and leeward sections, significant variations in amount and kind of zooplankton are apparent. These differences may well relate to seasonal changes in the flow pattern around Hawaii.

In addition to the environmental studies connected with the gross seasonal changes of the skipjack fishery, studies have been undertaken to determine factors in the environment which may be associated with local concentrations of fish. During the year an area in the vicinity of Cape Kaea, Lanai, where skipjack could be brought to the surface any time during spring and summer was studied intensively. This "concourse" provides an ideal laboratory to determine the environmental factors which make the location particularly attractive to skipjack. Experiments to determine the reason for the persistent occurrence of skipjack here are still in progress.

Another study has been initiated which is concerned with the influence of environmental factors on local fluctuations in the availability of skipjack. This is a study of temperature discontinuities as possible food-concentrating mechanisms. One such temperature discontinuity has been persistently found in the vicinity of the Lanai concourse. Preliminary investigations have shown that the discontinuity may contain 200 percent more fish eggs, 100 percent more fish larvae, and 50 percent more invertebrate plankton than the waters to either side of the discontinuity. The preliminary investigation also suggests that tidal currents in the vicinity of Lanai are involved in the formation of this discontinuity.

STUDIES OF MOVEMENTS OF FISH BY TAGGING: Tests of the dart-type tag, as a tool for studying the growth and migration of skipjack, are almost completed. From 10,360 releases, 1,038 or 10 percent have been recovered. Four long-term recoveries were obtained in which the skipjack had been at liberty for 260 to 282 days. The average growth of the fish amounted to about 7 pounds, or 0.8 pound per month. All recoveries were made within the commercial fishing area. The greatest net distance covered was about 330 miles, from Hilo, Hawaii, to Niihau.

The simplicity of the tag and rapidity of application, among other advantages, make tagging operations so efficient that the use of commercial sampans for this purpose becomes feasible. As a consequence, during the fiscal year, three charters were undertaken. The first was in September 1957 when 3,200 tagged fish were released in one week. During May and June 1958, two commercial sampans were chartered, one for operations in the vicinity of the island of Hawaii and one in the vicinity of the island of Kauai. During a two-week period one vessel released 2,000 tagged fish and the other 1,700. It is hoped that the results from these latter releases will give us some indication of the direction from which the skipjack population enters the fishery.

Minor improvements in the tag are still being made. The latest of these was the replacement of the barb, which was a short piece of $\frac{1}{16}$ " nylon or lucite rod on the D-2 tag, with a new barb molded out of nylon. This change is not expected to affect the recovery rate, but may reduce breakages to a negligible amount during application.

The application of a dart tag is not, apparently, a particularly disturbing experience to the fish. On several occasions fish have been recovered immediately after their release while the vessel was still in the process of fishing and tagging from the same school. In another instance, a fish caught twice and tagged twice was captured a third time.

Tuna Behavior: DIRECT OBSERVATION OF TUNA: The usefulness of direct observations of tuna in relation to the circumstances affecting fishing in any program to improve fishing gear and methods is beyond question. The practicality of attempting direct visual observation at sea is, of course, another matter. During the early part of fiscal year 1958, POFI initiated a program for studying the behavior of tuna in their natural environment. A bucket constructed of steel and plastic in which the observer equipped with a breathing

device could watch the actions of a school of tuna during fishing operations was mounted on the research vessel Charles H. Gilbert. Although considerable data were obtained on the behavior of chum and of the tuna themselves during the direct observation by the observer, it became apparent that both still and moving pictures were desirable. Late in fiscal year 1958, a new bucket was constructed in which the observer could both directly observe and photograph the behavior of tuna without himself being submerged in the water. Several experiments were designed and successfully brought off in which a single variable affecting fishing was modified and the results of such modification clearly observed and documented. The usefulness of this method of direct observation seems to have been demonstrated.

RESPONSE OF TUNA TO FISHING GEAR: A preliminary study of the relation between water clarity and the efficiency of gill-netting and trolling for albacore was completed. The results showed that both sampling methods were affected—trolling in a negative sense and gill-netting in a positive sense.

VARIATIONS IN THE RESPONSE OF SKIPJACK TO CHUM: A study of data collected from sampans fishing skipjack by the live-bait method and of the stomach contents of the skipjack caught was completed with the following results:

Fifty-two percent of the schools chummed yielded no fish. The rate at which skipjack are caught during the fishing of a school increased to a peak and then decreased with elapsed fishing time. The percentage of fish in the stomach contents decreased with a decrease in skipjack size while the percentages of molluscs and crustacea increased. The genera Decapterus and Cubiceps of the families Carangidae and Nomeidae, respectively, were the most important fish in the diet of the skipjack. The rate of catching large skipjack increased with distance from land. Fishing duration after the time of the highest catch rate was negatively correlated with the mean volume of the stomach contents. (Fishing of a school lasted longer if the stomachs were emptier.) Post-peak duration was also negatively correlated with the stage of digestion of the stomach contents. Skipjack feeding on fast-swimming fish were caught at a faster rate and fished for a longer period than those feeding on slow-swimming fish. Biting response was not affected by the time of day or weather conditions.

LARVAL TUNA PROJECTS: These projects were designed to solve problems in the identification and description of the larvae of various species of tuna and in their quantitative sampling. For the first mentioned, considerable work was done on material from the Dana collections, especially on Auxis and various species of Euthynnus. In an attempt to develop a good quantitative measure of larval tuna abundance, some 335 plankton samples were sorted for larval fish during the year. Most tuna larvae were captured between the surface and 60 meters' depth, with about 20-25 percent of the catch surface and 60 meters' depth, with about 20-25 percent of the catch between 70 and 130 meters, and practically none between 140 and 200 meters. There were marked day-night differences in catch at the surface but these became less at greater depths and were not present

in the 0-200 meter catches. Diurnal differences in the catch were attributed to vertical migrations and to dodging of the net during the day. Some evidence was presented indicating that the 60° F. isotherm may be limiting to the occurrence of tuna larvae. It appeared that the 0-200 meter tow produced more reliable abundance estimates than more shallow tows. No significant relation was found between the number of yellowfin taken by long line and the number of their larvae captured by the 0-200 meter plankton tows. Similarly, no significant relation was obtained between the number of skipjack schools sighted per 100 hours' scouting and the number of larvae taken by 0 and 00-60 meter tows.

TUNA SEROLOGY AND PAPER CHROMATOGRAPHY: In an attempt to develop methods which might enable an identification of larval tuna to be made without reference to morphological characters and to distinguish populations of various species of tuna when it becomes appropriate to study this problem, a joint study was begun with Bureau installations in Seattle on the serology of tuna as a means of distinguishing species and different populations of the same species. Numerous blood serum samples were collected from albacore, skipjack, yellowfin, little tuna, and dogtooth tuna and shipped to the Seattle Biological Laboratory. Preliminary tests showed no individual differences among albacore, but slight to moderate differences among individual skipjack and yellowfin. In general, species separation of adult tuna is quite easily achieved with serological techniques. A microdiffusion technique requiring 0.02 milliliter of serum was also employed successfully in distinguishing species. Initial tests of paper chromatography as a tool for differentiating species of tuna were conducted late in the year. If successful, it is hoped to employ this technique for the identification of tuna larvae. No definite report can be made as yet on the results.

QUANTITATIVE TUNA FORAGE SAMPLING PROJECT: In order to better understand the relation of tuna abundance and tuna forage, laboratory analysis was completed on approximately 288 mid-water trawl collections taken on 23 cruises, employing trawls of four types, and the data are being studied critically. These data were obtained through the operation of a 6-foot beam trawl, a 1-meter ring trawl, a 6-foot Isaacs-Kidd trawl, and a 10-foot Isaacs-Kidd trawl. A Nanaimo-type mid-water trawl was obtained late in the year and will be tested on forage organisms next fall.

ARTIFICIAL CULTIVATION OF TUNA BAIT FISH: The apparent magnitude of the populations of surface dwelling tunas about island areas in the tropical Pacific would seem to be beyond the capacity of available bait-fish supplies to permit adequate levels of exploitation using the live-bait fishing method for the capture of tuna. This is clearly true for, as an example, the Hawaiian skipjack fishery. Also for that fishery, the principal species of bait presently being utilized has a low survival potential. POFI is engaged in a 4-point program to help alleviate these conditions. Since it had been demonstrated that young tilapia (*Tilapia mossambica*) was a satisfactory bait fish for use in the skipjack fishery, and since it appeared to offer the best possibilities for bait-fish culture of the immediately available species, our efforts

have been concentrated on this fish. First, a laboratory program is continuing with studies of the ecology, nutrition, and diseases of young tilapia. Second, in collaboration with a local fishing concern, a semicommercial-scale plant was established to determine the economic possibility of rearing large quantities of bait-size tilapia in concrete tanks under well-controlled conditions. This project got under way in January when the brood tanks were stocked with 2,000 adult fish. The production of young during the spring months has been as follows: February 768, March 20,190, April 20,629, May 31,200, June 160,000; Total 232,787. With the advent of increased water temperature, the plant is now producing close to the anticipated yield of young fish. Moderate mortalities have been experienced due to a variety of diseases and to predation by dragonfly larvae.

In addition to this rearing project, a contract was negotiated with the Hawaii Division of Fish and Game concerning a program for rearing tilapia in small ponds to determine the biological and economic success of this culture method as compared with the more concentrated tank system.

Attention was also given to other species which might be useful in solving Hawaii's bait-fish problem. In cooperation with the Hawaii Division of Fish and Game, POFI arranged for the introduction of a small lot of threadfin shad (*Dorosoma petenense*) which will be cultured and tested as a tuna bait fish, and varying amounts of the Marquesan sardine were released in Hawaiian waters following each trip to the Marquesas area. Though there have been several recoveries, there is no clear indication that the species has become established here.

Albacore: DISTRIBUTION: Two facets of albacore distribution in the North Pacific were studied during the past fiscal year. The first was concerned with fish in the central and eastern areas and the second in the northern areas of the west coast of North America. These studies were directed towards an understanding of the relations between variations in albacore abundance and variations in the physical and biological features of the environment. The results indicate, when considered with returns from tagging, that (1) both of the major North Pacific fisheries, American and Japanese, fish the same stock or stocks of albacore. (2) the migration route of the albacore between these two fisheries is through the central North Pacific and is such that an untapped resource is present in this area during the summer, and (3) a tentative hypothesis can be drawn concerning the details of albacore migration through the central North Pacific. This hypothesis suggests that there are three groups of migrating fish with the one containing the smallest fish performing a complex migration between the fisheries. A portion of this group is retarded in their movement to the west coast by the development of summer productivity in the boundary between warm transition zone water and nutrient-rich subarctic water south of the Aleutian Islands.

Plans have been completed for the assessment of the commercial potential of this group of fish south of the Aleutian Islands. A contract has been awarded to a commercial vessel to test the commercial feasibility of this area this summer (July-

September 1958). Concurrently, a POFI vessel will conduct a survey of biological and oceanographic conditions associated with the presence of albacore in the area and will also conduct a limited amount of fishing to determine the efficiency of certain fishing gears.

The Northeastern Pacific Albacore Survey (NEPAS) was conducted in July-August 1957 to map the distribution of albacore off the northern portion of the United States west coast, and to determine whether the distribution was related to oceanographic and biological phenomena. NEPAS differed from previous albacore cruises in that it represented a transition from broad to more specific studies. A different survey method was also used so that detailed problems of microdistribution could be investigated. Instead of having a Bureau vessel do both fishing and related oceanographic and biological studies, 7 commercial vessels were employed in a quasi-synoptic trolling survey while two Bureau vessels made detailed studies of the microdistribution of albacore and biological and oceanographic conditions. Preliminary analysis of the fishing and oceanographic data indicates that albacore were scattered throughout the area, with concentrations of possible commercial magnitude found on the warm side of the band of upwelling along the coast. The largest of these concentrations were in cells or tongues of warm water which extended shoreward between cells of cold water.

BIOLOGY: In August 1957 a biologist was sent to American Samoa to institute an albacore gonad sampling program at Pago Pago. Long line-caught albacore from a wide area in the tropical Pacific are delivered throughout the year to the cannery by Samoa-based Japanese fishing vessels. Arrangements were made to obtain seven pairs of gonads from each vessel landing. Cannery personnel were instructed to weigh and measure the fish and collect the gonads which are shipped frozen to POFI for study.

The program progressed satisfactorily and as of April a total of 964 albacore was sampled. Each shipment of gonads was accompanied by an excellent log which gave the length and weight of each fish as well as the location of its capture. Laboratory examination of the gonads will commence early next fiscal year.

Two survey projects of general interest were completed. One involved assembly of all available Pacific albacore catch records to see if there was any indication of a leveling off of landings despite generally rising effort. Though the data are somewhat unsatisfactory they give no indication that fishing is affecting the stocks. Rather, there is a parallel rise of effort and catch through a background of erratic fluctuations. The second project was to assemble all data on seasons and areas of catch of Pacific albacore.

TAGGING: Seven albacore tag recoveries were reported during the year. This brings the total of POFI recoveries to 11. The data for all recoveries are summarized in table 2.

Of the 7 recoveries, 4 were of fish tagged off the West Coast during NEPAS. Two of the NEPAS recoveries were relatively short-term and were

retaken in 47 and 77 days, respectively. Both fish showed little net movement during the intervals and were recaptured during the same season in the West Coast fishery. The other two NEPAS releases (Nos. 10 and 11), one of which was a release by the chartered vessel, the M/V Flicker, and the other by the Hugh M. Smith, were recaptured on the Japanese side of the Pacific in little less than a year; each showed a net movement of more than 4,000 miles. These fish had moved clear across the Pacific from the American fishery to the Japanese live-bait fishery and were retaken there.

In addition, there were two recoveries of fish tagged in mid-ocean; one was tagged in October 1955 and the other in July 1956. The first fish was recaptured in the Japanese long-line fishery in November 1957 and the second in the United States west coast fishery in July 1957, thus demonstrating once again a movement in both directions from mid-ocean. Another recovery was of a fish tagged off California in November 1956 and retaken in the Japanese long-line fishery one year later. These tag recoveries support the contention that there is a single intermingling population of albacore in the North Pacific.

The last recovery (No. 11) was of particular interest since this was the first time in which an albacore was successfully tagged with the POFI dart tag. This albacore was one of 111 released with the POFI-developed dart tags during NEPAS.

EASTERN NORTH PACIFIC TEMPERATURE CHARTS: One of the prime difficulties in oceanographic work is in obtaining synoptic data over a wide area. The meteorologist is not presently confronted with this problem because he has a network of weather stations at his disposal over most land masses. He can also obtain synoptic reports of weather conditions at sea from commercial and naval vessels.

These marine weather reports have been made available to us by the Honolulu office of the U. S. Weather Bureau. Ships' messages relayed to the Weather Bureau include, among other things, reports of position, sea and air temperatures. We have utilized the sea temperature data to construct quasi-synoptic charts showing isotherms east of the 180° meridian. Data are taken from the middle 10 days of each month, plotted, and averaged over 1-degree squares. The resultant isotherms give us a picture of sea temperature from the Aleutian Islands to about 20° N. latitude. Combined with Japanese charts to the west of 180° the surface distribution of temperature is available for the entire North Pacific.

In the region between 30° S. to 20° N. latitude, temperatures are shown as averages over 1-degree squares. The averages themselves are shown because in this region shipping coverage is insufficient to allow us to draw isotherms.

Charts have been completed for each month in 1957 and will be prepared for all months of 1958. Data available for certain seasons prior to 1957 will also be utilized. In addition to the isotherm charts, charts are prepared which show variations of temperature from the 30-year mean and year-to-year variations.

The temperature anomalies which these charts show raises the question as to the mechanism of generation of such anomalies. For example, are

the temperature anomalies which these charts show raises the question as to the mechanism of generation of such anomalies. For example, are

Table 2 - POFI Albacore Tag Recoveries

No.	Date Tagged	Position of Release		Date Recaptured	Position of Release		Distance Traveled (Miles)	Days Out	Weight Gained (Lbs.)
		Latitude	Longitude		Latitude	Longitude			
1	10/4/54	46°30' N.	159°18' W.	11/28/55	35°45' N.	157°39' E.	2,055	420	-
2	10/5/54	43°31' N.	161°16' W.	1/19/56	35°23' N.	141°20' E.	2,670	471	ca. 40
3	10/9/55	42°16' N.	147°16' W.	6/24/56	31°54' N.	158°37' E.	2,660	259	ca. 4
4	10/17/55	44°55' N.	144°48' W.	8/1/56	31°21' N.	117°17' W.	1,515	288	ca. 6
5	7/31/56	44°31' N.	174°55' W.	7/23/57	30°08' N.	119°03' W.	2,775	357	ca. 5½
6	8/1/57	34°49' N.	121°57' W.	9/17/57	34°49' N.	121°26' W.	26	47	-
7	7/22/57	35°43' N.	122°58' W.	10/7/57	36°24' N.	123°07' W.	41	77	-
8	10/16/55	43°40' N.	144°40' W.	11/23/57	33°22' N.	174°07' E.	2,025	769	ca. 22
9	11/17/56	36°44' N.	127°37' W.	11/17/57	38°08' N.	174°53' E.	2,800	365	ca. 15
10	7/23/57	42°20' N.	127°33' W.	5/26/58	32°15' N.	144°15' E.	4,230	287	ca. 6
11	7/22/57	47°00' N.	126°18' W.	6/10/58	33°40' N.	144°00' E.	4,300	323	-

the colder than average waters the result of reduction of incoming solar radiation, the advection of relatively colder waters, or the result of mixing caused by greater wind stresses? Probably all of these factors enter into the picture. In order to evaluate one factor, namely differences in incoming radiation, we are in the process of examining cloud cover data from ships' reports on file at the U. S. Weather Bureau and the University of Hawaii.

From the observed cloud cover distribution an estimate of the energy available to the sea from direct solar radiation can be attained. This will at least tell us about the part insolation plays in the

development of relatively warmer or colder waters.

The surface isotherm chart is a useful presentation from several points of view. To the oceanographer temperature contours give an indication of current direction since flow tends to take place parallel to isotherms, at least in the regions of swiftest flow.

* * * * *

UNDERWATER PHOTOGRAPHIC EQUIPMENT TESTED AND TUNA FEEDING BEHAVIOR STUDIED (M/V Charles H. Gilbert Cruise 39): Underwater Observation

Techniques: Underwater photographic equipment was tested by the U. S. Bureau of Commercial Fisheries research vessel Charles H. Gilbert during a cruise from May 30 to July 3, 1958. Movies were taken of a strip of plyboard 48 x 8 x ½-inches divided into 8-inch square panels of white, gray, black, blue, and red. Distances varied from 10-100 feet. Various types of film were observed when exposed at the recommended exposure opening, and at one stop above and one stop below the recommended opening.

Water bubbles caused by turbulence gave much trouble. Fishing was tried at a dead stop, with the ship going at 50 r.p.m. (slower than usual fishing speed), and chumming was done from the position of the forward brine tanks. This worked best and movies were taken out of the side porthole. Water was prevented from slopping over the top of the observation chamber by the attachment of a plyboard hatch cover.

Skipjack Feeding Behavior: Experiments to determine the effect of dead bait, water sprays, tilapia, differing rates of chumming, and sound on skipjack feeding were conducted at the Lanai concourse. In general, the activity of the skipjack was lessened and the skipjack went deeper with tilapia, dead bait, and without sprays. The effect of changing the rate of chumming depended on the size of the school. In small schools the skipjack fell back with increased chumming, but in large schools, activity increased with increased chumming. Sound caused by beating on the hull with metal hammers had no effect.

The effect of water sprays on the feeding of 20- to 30-pound skipjack was tested. The skipjack seemed to be closer to the surface when the sprays were on.

Sea Scanar Observations: The port transducer of the sea scanar was not tilting properly at the beginning of the cruise. On June 28 the tilt control of the starboard transducer was also found to be faulty.

Test of the Floy Dart Tag: Off Cape Kaea, Lanai, 479 skipjack were tagged and another 120 were tagged north of Kahului, Maui. Of these, 318 were tagged with the Floy tags. Of the skipjack caught, 10 percent were saved as samples for length, weight, stomach contents, and gonad condition.

Oahu Environmental Monitoring Survey: Bathythermograph casts were made and surface salinities collected at various stations off Oahu Island during May 30-June 1 and again during June 20-21.

IGY Stations: Stations No. 11 and No. 12, established for the International Geophysical Year were occupied according to routine on May 30 and June 21-22. During the first occupation, two additional 0-300 meter Nansen bottle casts were made for temperatures and salinity samples.

Lanai Environmental Survey: Bathythermograph casts, collection of surface salinity samples, and plankton tows were accomplished as prescribed for various stations off Lanai except for 4 stations where hazardous circumstances precluded work.

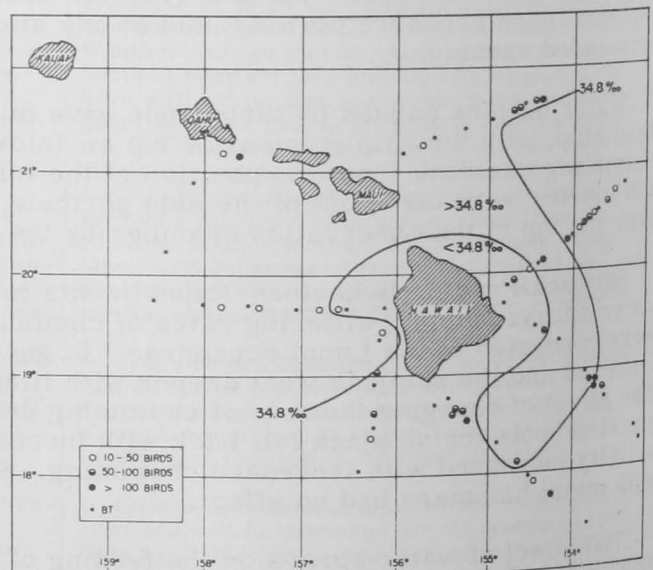
General Observations: Ten dolphins (*Coryphaena hippurus*) were caught on the trolling lines. Weather observations were recorded and transmitted whenever the ship was at sea and as time permitted.

* * * * *

OBSERVATIONS TO DELINEATE NORTHERN BOUNDARY OF DOWN-STREAM CALIFORNIA CURRENT TYPE WATER NEAR HAWAIIAN ISLANDS (M/V Charles H. Gilbert Cruise 40): During the cruise 40 (July 14-21, 1958) of the research vessel Charles H. Gilbert six lines of stations were run during daylight hours extending from land seaward in order to delineate by means of surface salinity and temperature observations the northern boundary of down-stream California Current type of water. On these runs, bathythermograph and surface salinity observations were made every 3 hours and a careful watch was maintained for bird flocks as signs of fish schools. In addition, seven 60-meter oblique plankton tows were made near the start and finish of several seaward legs. The vessel is operated by the Bureau of Commercial Fisheries Pacific Oceanic Fishery Investigations from Honolulu.

On two legs to the southeast of Hawaii the boundary between the western North Pacific water and down-stream California Current water was well defined by sharp salinity gradients. On the average these gradients were approximately 5 times as great as the average latitudinal rate of change of salinity between 10° and 22° N. and can be readily detected.

The active bird flocks with more than 50 birds are predominantly found in the lower salinity water and specifically in the vicinity of the boundary between western North Pacific and downstream California Current water (see figure). On one of the two crossings of the boundary to the southeast of Hawaii, 4 large schools were sighted one of which was positively identified as skipjack tuna.



Charles H. Gilbert Cruise 40. Bird flock sightings & salinity boundary.

The absence of bird-flock activity was particularly pronounced on the run from Maui northeastward to 75 miles offshore and from Kailua, Hawaii, westward. In each case the salinity encountered was well above that encountered in areas where bird flocks are found.

Incidental to the scouting, a small temperature discontinuity 10 miles south of the southern tip of Hawaii was encountered. Three surface plankton tows were made, one in the discontinuity, and one on both sides of it.

The eddy in the lee of Hawaii, which has been described by POFI scientists as a semipersistent feature, was also crossed. It appeared to be centered about 30 miles west of Kailua, Hawaii.



Portion Control Automatic Machine for Fish

An automatic portion control machine for fish processing has been developed by a Washington State poultry equipment firm. The unit also has application in the rest of the food processing industry.

The unit has a capacity of 2,700 pieces an hour, with accuracy reported to be within a fraction of an ounce.

In operation, pieces of frozen fish travel along a conveyor track to be sorted into six weight groups between 4 and 10 ounces.

Two stations are assigned each weight group to synchronize with the movements of an operator using both hands to load the conveyor.

A beam balance at each station is connected by a solenoid coil to the tripping mechanism. Mercury switches are used throughout. (Frosted Food Field, June 1958.)



Red Tide

FEDERAL AND STATE BIOLOGISTS SEEK MEANS OF CONTROL: A relentless search for a weak spot in the life cycle of the organism responsible for the red tide is being sought by biologists of the U. S. Bureau of Commercial Fisheries. Red tide is a water condition which has occurred periodically in the Gulf of Mexico for more than a century. It is often accompanied by fish kills so great that untold millions of dead fish float for miles along adjacent shores. It gets its name from the color of the water, often but not always red. The coloring is caused by the presence of Gymnodinium breve, an organism so tiny that more than a thousand of them could line up on an inch of hair. The organism is probably always present, but develops into dangerous proportions with great rapidity when conditions are right to start the "bloom."

The last outbreak occurred in October 1957 off Florida's West Coast. Past research has indicated that application of copper sulphate to an infested area might bring about the desired results. Many tons of this material were used in an effort to break the back of the October outbreak which appeared and developed suddenly in spite of the many official and unofficial sea and air patrols made to spot any indication of red-tide infestation.

At a meeting early this year at the Galveston, Tex., research laboratory of the Bureau, 33 American scientists representing State, Federal and private research

groups met to evaluate past red-tide research and to formulate plans for the continuing of red-tide investigations.

The scientists generally agreed that the copper sulphate treatment, given a good test during the fall, was not the answer to the problem for three reasons--the cost of extensive application would be enormous; its effect is short-lived; its side effects on other marine life is uncertain. It was also agreed that the cost of patrolling Florida's west coast on a round-the-clock basis to spot incipient outbreaks would require fantastic numbers of men and machines. The concensus was that victory over red tide seems a long way off and that victory can best be won by hard work and through the cooperative efforts of State, Federal and private agencies.

A final decision of the type of cooperative program to recommend was held in abeyance pending a thorough sifting of all data presented. But the probable line of attack will be a close-knit effort by the Florida State Board of Conservation and the Bureau. This approach will include:

(1) continued laboratory studies with living red-tide organisms to seek a control mechanism, possibly some associated-microscopic animal food element or chemical that checks red-tide growth; (2) exhaustive studies to be made in selected areas on Florida's west coast to determine the conditions of life required by the red tide. It is the hope of the biologists that a better knowledge of the organism in its natural surroundings, coupled with the results of laboratory studies, may show a weak link in the life cycle that will allow its effective control by man.

Bureau biologists, who have been investigating the problems for the past 11 years, showed that the red-tide organism, first isolated in 1947, is widely dispersed in the Gulf of Mexico. Painstaking research at the Galveston laboratory has produced bacteria-free cultures of red tide that are poisonous to fish, a demonstration vital in proving that massive outbreaks of the organisms in nature are the direct cause of fish kills.

The first recorded appearance of this fish-killing plague was in 1844. It occurred again in 1954, 1878, 1882, 1883, 1908, 1916, and in 1946. Its earlier appearances have been described as "poison water," "black water," "yellow water," and "rotten water." The term "red tide" is actually a misnomer for there is no "tide" and sometimes the water is green interlaced with yellows and browns.



Salmon

ALASKA'S AFOGNAK FISHWAY BRINGS LARGE RED SALMON RUN TO ONCE BARREN WATERSHED: A large run of 7,000 adult red salmon, derived from planted eggs, returned during June and July 1958 to the Pauls Bay Fishway on Afognak Island, the Director of the Alaska Department of Fish and Game, reported on July 23, 1958.

This is the largest run of reds since the Department surmounted the 23-foot falls with a fishway in 1952, to open the hitherto barren 550-acre Laura Lake to salmon spawning. The higher rate of survival of the 1958 red salmon indicates that runs of commercial importance will be returning to Laura Lake much sooner than was expected.

The 7,000 red salmon that ascended the ladder this year were produced from a 1954 plant of 450,000 eggs taken from 180 females in nearby Perenosa Lake.

Since the Department constructed the fishway to open Laura Lake, eyed eggs have been planted in the lake's inlet stream to introduce runs to the once barren area.

Returns of adult red salmon in 1955, 1956, and 1957 from the egg plants made in 1951, 1952, and 1953 fluctuated between 200 and 500 adult fish yearly. The annual planting ranged from 210,000 to 500,000 eggs.

It is estimated by Department biologists that an annual catch of 10,000 red salmon and an escapement of 7,000 would assure a good sustained yield for a watershed of this size.

One of the main functions of the Commercial Fisheries Division of the Department is to open up watersheds now blocked by falls and other barriers to salmon spawning.

There are numerous potentially-productive watersheds in Alaska, now blocked by falls, which would lend themselves to this type of a program, the Director states. Some of these are now under investigation for further fishway possibilities.



Saltonstall-Kennedy Act Fisheries Projects

ALLOCATION OF FUNDS FOR COMMERCIAL FISHERIES PROGRAMS: The allocation of \$5,042,000 of Saltonstall-Kennedy funds for commercial fishery investigations during the fiscal year ending June 30, 1959, were approved on July 13 by Secretary of the Interior Fred A. Seaton.

The Saltonstall-Kennedy Act provides that 30 percent of the money derived from import duties levied on fishery products be directed to increasing the production and consumption of domestically-produced fish and fishery products. The activity is under the jurisdiction of the U. S. Bureau of Commercial Fisheries.

Almost \$700,000 is included for various projects relating to salmon, such as \$608,500 for projects in Alaska and \$100,750 for North Pacific studies which will include considerable salmon work.

Other allotments are: Northwest Atlantic fisheries, \$539,000; Great Lakes and inland waters, \$174,000; sardine studies, \$387,350; oyster projects, \$300,300; shrimp, \$295,000; tuna, \$258,000; menhaden, \$87,000; striped bass, \$56,500; king crab, \$22,500; Pacific Coast rockfish, \$16,000. There was \$112,000 provided for the study and control of red tide, \$54,800 for Pacific oceanographic studies; \$24,000 for hydrographic studies on the Atlantic Coast; \$10,000 for fishing vessel and insurance studies, and \$54,185 for coordination of Saltonstall-Kennedy projects in southern California.

Allocation for activities not necessarily related to a specific fish or fishery include: economic studies, \$152,000; Market News, \$130,000; promotion of use of domestically-produced fishery products through fish-cookery demonstrations, and related public service radio and TV demonstrations, \$100,000; market promotion, on a national scale, through cooperation with press, radio, TV, and other media at local, State or national levels, \$257,000; market research and analysis studies and related activities on a national scale, \$160,000; coordination of these marketing activities, conduct of foreign marketing programs, and liaison and consulting services, \$61,000; special reports on trade, tariff and legislation, \$74,000; continue collection throughout the United States of fishery statistics on operating cost, catch, and manufactured products and the expediting of publication of these data for use by the industry, the States and other S-K projects, \$175,700; gear research, \$62,500; and technological studies on subjects of national scope, including standards for fishery products, new uses for fish oils, and nutritive quality of fish meal, and Great Lakes fisheries utilization problems, \$390,915. In addition \$296,000 was allotted for administrative purposes.

Note: See *Commercial Fisheries Review*, March 1958, p. 29.

The money made available for salmon investigations will be utilized as follows: development of methods of counting and recording escapement, \$162,000; studies of migrations, predators, the effects of logging and other environmental factors, \$240,000; development of more accurate methods of predicting salmon runs, \$153,000; analysis of fishery research data already accumulated and supervision of contact projects, \$30,500; fishery surveys of Alaska rivers north of Bristol Bay, \$23,000.

All three of the herring or sardine areas are getting funds for various types of investigations--for the identification of the Alaska herring populations and for the development of methods of predicting abundance, \$119,000; for a cooperative program of research on the fluctuation in abundance of the Pacific (California) sardine, anchovy, and mackerel, \$116,350; for biological studies of the Maine herring or sardine, \$102,000, to be used together with another \$50,000 in the exploration category.

The funds to be used on the oyster projects are distributed as follows: New England research, \$100,000; Middle Atlantic, \$128,000; Gulf of Mexico, \$32,000; technological studies in Middle Atlantic and Gulf States on background for oyster standards, and problems relating to the canning, freezing, and composition of fishery products in these areas were given \$40,300.

The shrimp funds are distributed \$131,000 for research on nursery grounds and shrimp migrations; \$48,000 for tagging shrimp at sea in the Tortugas fishery; \$91,000 for exploratory work in the Gulf and South Atlantic, and \$25,000 for a statistical survey of the Gulf of Mexico bait shrimp industry.

To provide additional research on albacore tuna and to define the location of stocks in waters north of Hawaii, \$225,000 has been made available; for a study of improving tuna quality by improving methods of freezing tuna at sea and bettering other stages of the processing \$33,000.

Great Lakes and inland fisheries research has been allocated \$103,000; explorations, \$36,000; and technological studies, \$35,000. Commercial propagation of catfish was given research funds of \$6,000.

Among the projects which should develop results beneficial to many sections of the domestic fishing industry are such studies as development of voluntary quality standards for fishery products, \$195,000; new uses of fish oils, \$100,000; studies on nutritive value of fish meals, \$46,415; effects of distribution upon frozen fish products, \$25,000; market research to determine basic marketing patterns for canned fish, \$42,000; and promoting the use of domestic fishery products through education and market development, \$416,500.

Tuna

MORE DETAILS ON NEW DEVELOPMENT IN FREEZING TECHNIQUES ON PURSE SEINERS: A new method for freezing tuna on vessels was developed in 1957 by a practical Pacific Coast fishing vessel engineer and some of the details were reported in the July 1958 issue of Commercial Fisheries Review (p. 44). Ves-



Fig. 1 - General view of the tuna purse seiner Jo Ann which is using the new method of freezing tuna on the vessel.

sels with a coil refrigeration system are plagued with inadequate refrigeration. Conversion to a brine-freezing system is very expensive. The new system is a compromise brine system which builds a reserve of ice on coils to meet refrigeration needs with a minimum of machinery. This additional information and photographs showing some details of the new system installed in the purse seiner Jo Ann were received from the San Pedro Market News Office.

Note in figure 5 that the fish in the lower portion are stacked fore and aft. Two men go into the hatch when the fish are being loaded aboard and guide them into position. The upper third are crossed more (crossed fish can be piled higher) because there is no room for a man to work below when the pile of fish reaches the top. This is no different than on regular brine-freezing vessels as they have the same problem. The fish frozen with the

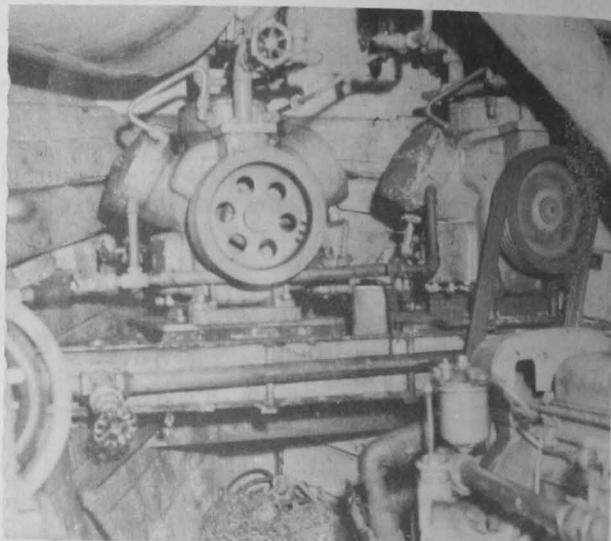


Fig. 2 - Two high-speed 6-cylinder ice machines with a capacity of 10 tons each aboard the Jo Ann. Direct drive off 3-cylinder 60 hp. auxiliary engine which also runs the brine-circulating pump and winch and which can run off 230-hp. main engine also.



Fig. 3 - Showing the hatch aboard the Jo Ann just a few minutes after the cover was removed and unloading commenced. The fish are yellowfin tuna averaging about 18 pounds each.

new coil system are all loose and can be picked out by hand, while in regular purse seiners with other refrigeration systems they would be still frozen to one another



Fig. 4 - Bringing up frozen yellowfin tuna from the hold of the Jo Ann. One of the planks which form one of the two fore and aft partitions is shown.



Fig. 5 - Starboard, or right side, of Jo Ann's hold. At the top are the small pipes (crisscross above the larger coils) which spray water on the larger coils (notice that they still have ice on them).

and would have to be broken loose by means of a bar or pick, which damages the fish.

The ice on the coils is built up to more than one foot in diameter (see fig. 6). When the brine water is released into the hold, this ice melts, rapidly cooling the brine water. When most of the ice is melted, the brine water is near 32° F., and the fish have been properly chilled. The temperature in the coils is then lowered to -20° F.; the temperature of the brine water then drops to -20° F.



Fig. 6 - Starboard view of the Jo Ann's hold. Notice ice on coils. These coils, as well as those on the sides, are the ones that the water is sprayed onto.

Note: Also see Commercial Fisheries Review, July 1958, p. 44.

* * * * *

CALIFORNIA'S PACK OF CANNED TUNA FOR JANUARY-JULY 1958 AT RECORD HIGH: The total California tuna cannery case pack January-July 1958 of 6.3 million standard cases set a new high for any comparable preceding 7-month period. This was 350,000 standard cases or 6 percent above the previous 7-month record high of 5.9 million cases in 1956. In January-July 1957 only 5.5 million cases were packed.

Principal factors accounting for a new high in the California canned tuna pack this year through July 31 were record tuna purse-seine catches and record-high frozen tuna imports.

The increase in the case yield--from 46.5 cases per ton of tuna for the first seven months of 1957 to 49.5 cases per ton for January-July 1958--was due to the fact that a larger percentage of the imports consist of gilled and gutted yellowfin tuna and the greater proportion of the pack consists of chunk-style.



United States Fishing Fleet ^{1/} Additions

APRIL 1958: A total of 58 vessels of 5 net tons and over were issued first documents as fishing craft during April 1958--13 more than during April 1957. The

Table 1 - U. S. Vessels Issued First Documents as Fishing Craft, by Areas, April 1958 with Comparisons

Area	April		Jan.-April		Total
	1958	1957	1958	1957	
(Number)					
New England	4	3	7	6	19
Middle Atlantic	-	2	3	12	23
Chesapeake	6	9	30	31	104
South Atlantic	5	9	37	28	130
Gulf	28	13	89	35	166
Pacific	10	5	28	19	102
Great Lakes	-	2	2	2	8
Alaska	5	2	8	10	48
Puerto Rico	-	-	-	-	1
Virgin Islands	-	-	1	-	-
Total	58	45	205	143	601

Note: Vessels assigned to the various sections on the basis of their home ports.

Table 2 - U. S. Vessels Issued First Documents as Fishing Craft, by Tonnage, April 1958

Net Tons	Number
5 to 9	21
10 to 19	11
20 to 29	5
30 to 39	8
40 to 49	11
50 to 59	1
90 to 99	1
Total	58

South Atlantic and Alaska areas 5 each, and the New England area with 4.

MAY 1958: During May 1958, 80 vessels of 5 net tons and over were issued first documents as fishing craft. Compared with the same month of 1957, this was an increase of 14 vessels. The Gulf States continued to lead with 27 vessels, the Pacific area was second with 17 vessels, and the South Atlantic third with 14 vessels.

Table 1 - U. S. Vessels Issued First Documents as Fishing Craft, by Areas, May 1958 with Comparisons

Area	May		Jan.-May		Total
	1958	1957 ^{1/}	1958 ^{1/}	1957 ^{1/}	
(Number)					
New England	1	3	8	9	19
Middle Atlantic	4	-	7	12	23
Chesapeake	7	8	38	39	104
South Atlantic	14	8	51	36	130
Gulf	27	8	117	43	166
Pacific	17	26	46	45	102
Great Lakes	1	1	3	3	8
Alaska	9	12	17	22	48
Puerto Rico	-	-	-	-	1
Virgin Islands	-	-	1	-	-
Total	80	66	288	209	601

^{1/}Revised.
Note: Vessel assigned to the various sections on the basis of their home ports.

Table 2 - U. S. Vessels Issued First Documents as Fishing Craft, by Tonnage, May 1958

Net Tons	Number
5 to 9	24
10 to 19	17
20 to 29	14
30 to 39	16
40 to 49	6
50 to 59	1
180 to 189	1
190 to 199	1
Total	80

Fishing craft that were issued first documents as fishing craft during the first five months of 1958 totaled

288 vessels--an increase of 79 vessels as compared with the same period of 1957.
^{1/}Includes both commercial and sport fishing craft.

Of the vessels documented for fishing, 41 percent were reported from the Gulf States.

JUNE 1958: During June 1958, 76 vessels of 5 net tons and over were issued first documents as fishing craft. Compared with the same month of 1957, this was a decrease of one vessel. The Gulf States continued to lead with 32 vessels, the Pacific area was second with 20 vessels, and the South Atlantic third with 10 vessels.

Table 1 - U. S. Vessels Issued First Documents as Fishing Craft, by Areas, June 1958 with Comparisons

Area	June		Jan.-June		Total
	1958	1957	1958 ^{1/}	1957 ^{1/}	
	(Number)				
New England . . .	2	2	10	11	19
Middle Atlantic . .	-	1	7	13	23
Chesapeake	6	12	44	51	104
South Atlantic . . .	10	19	61	55	130
Gulf	32	18	149	61	166
Pacific	20	19	66	64	102
Great Lakes	-	1	3	4	8
Alaska	6	5	23	27	48
Puerto Rico	-	-	-	-	1
Virgin Islands . . .	-	-	1	-	-
Total	76	77	364	286	601

^{1/} Revised.
Note: Vessels assigned to the various sections on the basis of their home ports.

Table 2 - U. S. Vessels Issued First Documents as Fishing Craft, by Tonnage, June 1958

Net Tons	Number
5 to 9	25
10 to 19	11
20 to 29	11
30 to 39	19
40 to 49	8
50 to 59	1
210 to 219	1
Total	76

Fishing craft that were issued first documents as fishing craft during the first six months of 1958 totaled

364 vessels--an increase of 78 vessels as compared with the same period of 1957. Of the vessels documented for fishing, 41 percent were reported from the Gulf States.



United States Fishery Landings

DOWN 11 PERCENT DURING FIRST SEVEN MONTHS OF 1958: Landings of fish and shellfish in the United States and Alaska during the first seven months of 1958 dropped 11 percent as compared with the same period last year. Fisheries which produced 1.8 billion pounds from January to July 1958, yielded almost 2.1 billion pounds from January to July 1957.

Menhaden, with landings of 701 million pounds, showed the greatest decline--132 million pounds less than in the same months of 1957. Increased menhaden landings in the Gulf States and in Virginia were more than offset by sharply reduced production in the Middle Atlantic and New England States. On the Pacific Coast, anchovies were down 31 million pounds and the catch of jack mackerel was off 29 million pounds. Maine herring was down 23 million pounds. Herring landings in Alaska were off 33 million pounds. Whiting receipts in Maine, and at Boston and Gloucester, Mass., were 35 million pounds this year as compared with over 55 million pounds for the same period in 1957.

Ocean perch in New England was up 17 million pounds over the similar 1957 period. Fish for industrial use in New England was likewise taken in greater volume--66 million pounds--up 8 million pounds. The catch of salmon in Alaska to August 10 was 38 million pounds greater than the 151 million pounds taken during this period in 1957.

United States Fishery Landings of Certain Species for Periods Indicated, 1958 and 1957 ^{1/}					United States Fishery Landings by States for Periods Indicated, 1958 and 1957 ^{1/}				
Item	Period	1958	1957	Total 1957	Item	Period	1958	1957	Total 1957
	 (1,000 Lbs.).....				 (1,000 Lbs.).....		
Anchovies, Calif.	6 mos.	4,536	35,850	38,650	Maine	6 mos.	89,213	105,048	290,528
Cod:					Massachusetts:				
Maine	6 mos.	1,987	1,587	2,032	Boston	7 mos.	81,851	91,271	135,072
Boston	7 "	9,782	12,363	17,487	Gloucester ..	7 "	112,433	141,905	248,928
Gloucester ..	7 "	1,842	1,167	2,020	New Bedford	7 "	68,391	50,357	104,334
Total cod .		13,611	15,117	21,539	Provincetown	7 "	10,055	13,594	25,109
Haddock:					Total Mass.		272,730	297,127	513,443
Maine	6 mos.	2,407	2,516	4,097	Rhode Island 2/	5 mos.	37,868	48,384	121,273
Boston	7 "	58,133	59,214	93,617	New York 2/...	6 "	21,274	23,021	40,223
Gloucester ..	7 "	7,399	6,474	8,898	New Jersey 2/	6 "	23,767	28,629	50,541
Total haddock		67,939	68,204	106,612	North Carolina 2/	6 "	32,142	30,590	64,634
Halibut 2/:					South Carolina 2/	6 "	4,701	4,177	24,316
Washington ..	7 mos.	12,142	11,399	20,733	Georgia	6 "	5,724	6,169	18,584
Alaska	7 "	15,421	17,330	15,430	Florida 2/...	6 "	71,943	65,905	140,698
Total halibut		27,563	28,729	36,163	Alabama	4 "	2,008	2,647	11,882
Herring:					Mississippi 2/.	5 "	3,751	5,787	19,991
Maine	6 mos.	23,926	47,100	153,621	Louisiana 2/..	1 "	2,551	2,994	63,322
Alaska	7 "	71,880	105,204	118,300	Texas 2/.....	3 "	8,720	10,972	77,156
Industrial fish,					Ohio (Mar.-June)	6 "	11,887	18,919	22,844
Maine & Mass. 3/	7 mos.	66,494	58,162	112,446	Oregon	5 "	18,003	17,921	56,660
Mackerel:					Washington ..	6 "	58,912	49,609	142,576
Jack	6 mos.	6,524	35,772	86,300	California:				
Pacific	6 "	10,578	8,410	55,200	Certain species 3/	6 mos.	162,380	226,552	496,748
Menhaden	7 mos.	701,123	832,741	1,683,143	Other	4 "	32,182	34,791	127,250
Ocean perch:					Total California		194,562	261,343	623,998
Maine	6 mos.	36,694	28,393	64,723	Rhode Island, Middle				
Boston	7 "	1,399	2,320	3,819	Atlantic, Chesapeake,				
Gloucester...	7 "	44,730	34,993	65,389	South Atlantic, and				
Total ocean perch		82,823	65,706	133,931	Gulf States,				
Salmon:					(menhaden only) 7 mos.		700,267	817,927	1,661,480
Washington ..	6 mos.	2,889	4,420	43,000	Alaska:				
Oregon	5 "	1,651	1,396	11,354	Halibut 4/...	7 mos.	15,421	17,330	20,733
Alaska	to Aug. 10	188,807	150,998	194,712	Herring ...	7 "	71,880	105,204	118,300
Scallops, sea, New					Salmon	to Aug. 10	188,807	150,998	194,712
Bedford	7 mos.	8,753	9,429	16,461	Total all above items		1,836,131	2,070,701	4,277,894
Shrimp (heads-on)					Other		5/	5/	472,106
South Atlantic and					Grand Total		5/	5/	4,750,000
Gulf States ..	4 mos.	32,453	33,679	166,737	1/ Preliminary.				
Squid, Calif. ..	6 "	3,050	5,602	10,758	2/ Excludes menhaden landings.				
Tuna, Calif. ..	6 "	137,692	140,918	386,724	3/ Includes catch of: Anchovies, jack and Pacific mackerel, tuna, and squid.				
Whiting:					4/ Dressed weight.				
Maine	6 mos.	8,048	7,610	15,810	5/ Data not available.				
Boston	7 "	205	879	1,002					
Gloucester ..	7 "	26,619	46,060	76,521					
Total whiting		34,872	54,549	93,333					
Total all above items		1,487,164	1,701,986	3,468,984					
Others (not listed)		348,967	368,715	1,281,016					
Grand Total		1,836,131	2,070,701	4,750,000					

1/Preliminary. 2/Dressed weight. 3/Excluding menhaden.



U. S. Fish Stick Production

APRIL-JUNE 1958: The United States production of fish sticks during the second quarter of 1958 totaled 13.8 million pounds, an increase of 2.6 million pounds (or 23 percent) as compared with the second quarter of 1957. The peak month of the 1958 second quarter was April when 4.9 million pounds were reported, June was the second highest month with 4.7 million pounds, while during May 4.2 million pounds were reported.

Month	Cooked	Uncooked	Total
	(1,000 Lbs.)		
April	4,345	511	4,856
May	3,718	511	4,229
June	4,220	483	4,703
Total 2nd Quarter 1958	12,283	1,505	13,788
Total 2nd Quarter 1957	10,113	1,108	11,221
Total First 6 Months 1958 . .	27,929	2,796	30,725
Total First 6 Months 1957 . .	23,284	2,420	25,704

^{1/}Preliminary.

The Atlantic Coast States led all other areas with 11.4 million pounds (or 83 percent) of the total production. The Inland, Gulf Coast States, and the Pacific Coast States accounted for the remaining 17 percent.

Area	1958 ^{1/}		1957 ^{2/}	
	Number of Firms	1,000 Lbs.	Number of Firms	1,000 Lbs.
Atlantic Coast States	24	11,449	25	9,355
Inland and Gulf States	4	1,178	5	956
Pacific Coast States	11	1,161	11	910
Total	39	13,788	41	11,221

^{1/}Preliminary.

^{2/}Revised.

During the first six months of 1958, a total of 30.7 million pounds of fish sticks was produced--an increase of 5.0 million pounds over the same period of 1957. Cooked fish sticks were up 4.6 million pounds, while the production of uncooked fish sticks was up 376,000 pounds.



United States Commercial Fisheries Gear

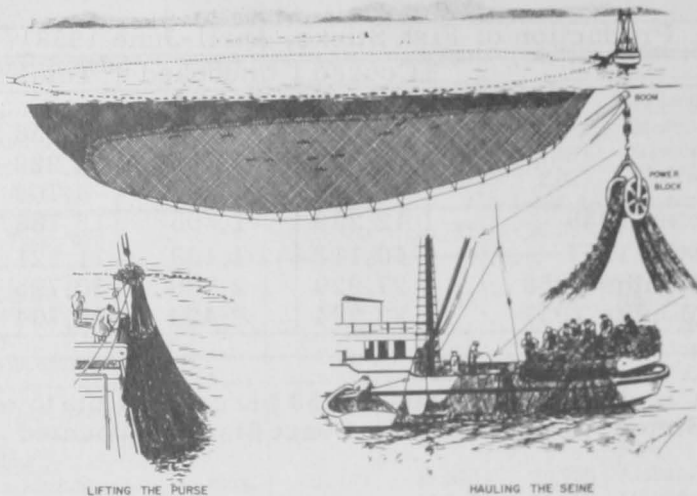
Nearly 14 million fish hooks of assorted sizes, and more than 1 million crab, lobster, and spiny lobster pots of varied design, are part of the fish gear used to capture the fish and shellfish for the United States consumer.

But despite these imposing numbers, only about 11 percent of the annual fish harvest is taken by these types of gear, U. S. Bureau of Commercial Fisheries records show. It is the purse seine and the otter trawl which not only bring in the largest catch of food fish but of industrial fish as well.

The 14 million hooks may be utilized at the rate of a fourth of a hook to a line, as in the case of some tuna fishing when it takes four lines, four poles, four men--and one hook--to bring in the big ones; or there may be as many as a thousand hooks on an attached series of lines in the fisheries that use the long-line gear. In many more instances the use of a single line and hook by one fisherman does the work satisfactorily in making catches of grouper, snapper, and tuna.

Bureau records show that the various hook-and-line combinations in recent years caught more than 450 million pounds of fish a year. The catch with pots has been averaging about 120 to 130 million pounds a year. The total annual harvest of all fish and shellfish for the last few years has approximated 5 billion pounds, sometimes a bit higher, sometimes lower.

SALMON PURSE SEINING



About 2,400 purse seines (which are used to encircle the schools of pelagic fish) catch about 2.4 billion pounds of fish annually, or nearly half the total harvest. Much of the catch consists of menhaden, but there is included in the total large amounts of salmon, tuna, mackerel, and Pacific sardines.

Otter trawls (a name applied to several types of gear towed over the bottom to capture many bottom-dwelling species) catch about 1 billion pounds annually, or 20 percent of the catch. The otter trawl brings in cod, haddock, ocean perch, flat fishes, whiting, and shrimp. There were more than 9,000 trawls in operation during 1957.

An average of 28,000 gill nets are responsible for 4 percent of the catch; 3,300 pound nets, which include fish traps, take 3-4 percent. Shellfish dredges bring in an average of about 100 million pounds of clams (meats), crabs, oysters (meats), and scallop (meats); the balance is divided between "stop" seines (used to cut off the retreat of fish entering coves), haul seines, and miscellaneous gear.



U. S. Foreign Trade

GROUND FISH FILLET IMPORTS, JULY 1958: Imports of cod, haddock, hake, pollock, cusk, and ocean perch fillets (including blocks) into the United States during July 1958 totaled 19.7 million pounds. Compared with the corresponding month of 1957, this was an increase of 4.2 million pounds. Canada continued to lead all other countries as supplier with 15.1 million pounds, or 77 percent of the month's total imports.

During the first seven months of 1958, these imports amounted to 86.2 million pounds--4.4 million pounds above the quantity imported during the same period of 1957. Imports from Canada represented 71 percent of the total. Iceland accounted for 23 percent, and the remaining 6 percent was comprised of imports from nine other countries.



The quota of groundfish and ocean perch fillets and blocks permitted to enter the United States at $1\frac{7}{8}$ cents per pound in the calendar year 1958 is 35,892,221 pounds, based on a quarterly quota of 8,973,055 pounds. The quota for the calendar year 1957 amounted to 37,375,636 pounds. Imports during individual quarters in excess of the established quarterly quota enter at a duty of $2\frac{1}{2}$ cents a pound.

Note: See Chart 7 in this issue

IMPORTS AND EXPORTS OF SELECTED FISHERY PRODUCTS, JANUARY-MAY 1958: Imports: GROUND-FISH FILLETS AND BLOCKS: Imports of cod, haddock, hake, pollock, cusk, and ocean perch fillets and blocks during January-May were about equal to the quantity imported during the corresponding period of 1957. Principal increases in imports of blocks or slabs and cod fillets from Iceland and Denmark were counterbalanced by declines in blocks or slabs and haddock fillets from Canada and ocean perch from Iceland.

A new groundfish product, "fish bits," has recently entered the United States in substantial quantity. This product consists of bits of fish derived from trimming fillets and the backbone of the fish after filleting. These bits are assembled and frozen into blocks (generally about 7 pounds) primarily for use in the preparation of fish flakes. By a ruling of the Customs Court at New York on June 4, 1957 (*Treasury Decisions*, June 13, 1957, Abstract No. 60817), such products were determined dutiable at one cent a pound, classified under Tariff paragraph 720(b), "fish, prepared or preserved, n.s.p.f." As a result, imports of "fish bits" are not included under the "groundfish fillet and block" classification.

FROZEN TUNA: Total imports through May this year were about 1 percent below those of the first five months of 1957. Frozen albacore imports were 25 percent less, but yellowfin and skipjack 17 percent greater. Receipts of yellowfin and skipjack from Peru declined by 8 million pounds, but those from Japan increased by 13 million pounds.

TUNA LOINS AND DISCS: In May 1958 practically no imports direct from Japan were recorded because of voluntary restrictive measures adopted by the Japanese. A gain was reported in receipts through Cuba as a result of Japanese operations in the South Atlantic. January-May 1958 imports of cooked tuna loins and discs were about half those of the first five months of 1957.

CANNED TUNA: During January-May 1958, canned tuna imports were 3 percent below those of the same 1957 period. Receipts of canned albacore or white-meat tuna were down 30 percent; canned light-meat tuna increased 12 percent.

CANNED BONITO: Imports from Peru in the first five months this year were 24 percent less than in the similar period last year.

FRESH OR FROZEN LOBSTERS: Imports this year January-May were 9 percent less than during January to May of 1957; principal decreases were in receipts from Mexico, Cuba, Australia, and New Zealand.

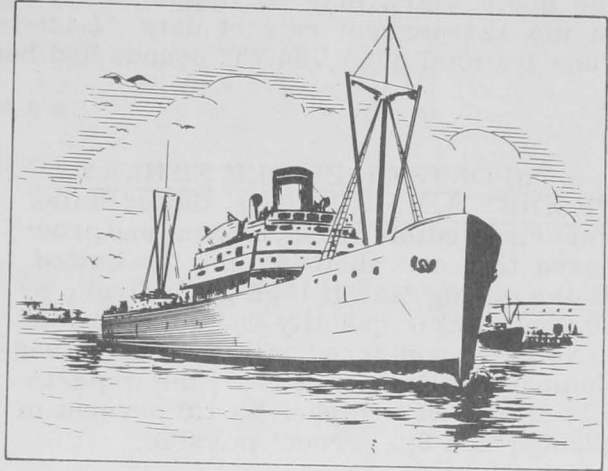
SHRIMP: Gains in shipments from Hong Kong and many sources in Central and South American countries primarily accounted for the 11 percent increase in shrimp imports the first five months of 1958. Receipts from Panama and Japan were less than in the same period of 1957.

CANNED OYSTERS: Receipts during January-May 1958 registered large gains, particularly from Japan. Quantities received were about double those imported in the comparable period of 1957.

CANNED SARDINES: Imports of canned sardines in oil January-May 1958 were 16 percent less than during the first five months of 1957. Imports of sardines, not in oil, were about six times those of the corresponding 1957 period, primarily the result of large gains in shipments from the Union of South Africa.

Reports indicate that in 1958 the South African pilchard canning industry will have the best season since the rec-

ord catch of 1952. After six years of reduced catches, the fish returned in abundance early in February and subsequent catches have been good. The April catch set a new record. Fish were reported within a few miles of the coast. Large quantities of jack mackerel were also available. According to reports, improved fishing was matched by greater sales to export markets, principally to the Philippines and other Far East countries.



CANNED SALMON: Increased shipments from both Japan and Canada have raised the imports for January-May 1958 to 160 percent of a year ago. In Japan, a substantial carryover of canned salmon from the 1957 pack was reported on hand early this year, but mid-year reports indicate it has been sold.

CANNED CRABMEAT: Imports during the first five months this year were about 12 percent below those of a year ago.

FISH MEAL: Imports during January-May 1958 were 17 percent above a year ago. Receipts from Canada declined to less than half those in the similar 1957 period, but large increases occurred in imports from Angola, Peru, Chile, and the Union of South Africa. Heavy catches of pilchards and mackerel in South Africa have resulted in increased exports of fish meal from South Africa to Great Britain, Western Europe, and the United States.

Exports: CANNED SARDINES, MACKEREL, AND ANCHOVIES: Compared to the first five months of 1957, exports during January-May 1958 of canned California sardines declined 64 percent; canned mackerel, 82 percent; and canned anchovies, about 89 percent. Major reductions in the domestic catch resulted in reduced exports of these products to established markets in Cuba, other Latin American countries, and the Philippines.

CANNED SALMON: Canned salmon exports during January-May 1958 were 51 percent less than for the similar period of 1957.

FISH OIL: Sharp declines were noted in shipments to Western Germany and the Netherlands; exports to Canada increased. Total exports of fish oil during the first five months of 1958 were 45 percent less than during the same period a year ago. Because of the large catches of pilchard and mackerel, South Africa's output of fish body oils and exports to Europe have increased. This probably has had an effect upon sales and exports of United States fish oils.

* * * * *

IMPORTS OF CANNED TUNA IN BRINE UNDER QUOTA: The quantity of tuna canned in brine which may be imported into the United States during the calendar year 1958 at the 12½-percent rate of duty has been established as 44,693,874 pounds.

Any imports in excess of this established quota will be dutiable at 25 percent ad valorem.

Imports from January 1-July 5, 1958, amounted to 20,407,245 pounds, according to data compiled by the Bureau of Customs. This leaves a balance of 24,286,629 pounds of the quota which may be imported during the balance of 1958 at the 12½-percent rate of duty. Last year from January 1-June 1 a total of 17,764,752 pounds had been imported.



* * * * *

IMPORTS OF EDIBLE FISHERY PRODUCTS, MARCH 1958: United States imports of edible fresh, frozen, and processed fish and shellfish into the United States during March 1958 were higher by 10.0 percent in quantity and 20.2 percent in value as compared with February 1958. Compared with March 1957, the imports this March were higher by 1.0 percent in quantity and 8.9 percent in value.

Item	Quantity			Value		
	Mar.		Year	Mar.		Year
	1958	1957	1957	1958	1957	1957
	(Millions of Lbs.)			(Millions of \$)		
Fish & shellfish: Fresh, frozen, & processed 1/2 . . .	68.5	67.8	837.0	22.0	20.2	248.4

1/2 Includes pastes, sauces, clam chowder and juice, and other specialties.

* * * * *

Table 1-United States Imports of Edible Fishery Products, April 1958 with Comparisons

Item	Quantity			Value		
	Apr.		Year	Apr.		Year
	1958	1957	1957	1958	1957	1957
	(Millions of Lbs.)			(Millions of \$)		
Fish & shellfish: Fresh, frozen, & processed 1/2 . . .	66.0	62.6	837.0	19.5	17.2	248.4

1/2 Includes pastes, sauces, clam chowder and juice, and other specialties.

IMPORTS OF EDIBLE FISHERY PRODUCTS, APRIL 1958: Imports of edible fresh, frozen, and processed fish and shellfish into the United States during April 1958 were down 3.7 percent in quantity and 11.3 percent in value as compared with March 1958.

Compared with April 1957, the imports this April were higher by 5.4 percent in quantity and 13.4 percent in value.

Wholesale Prices, July 1958

The July edible fish and shellfish wholesale price index, although slightly lower, was still very close to the June record peak when it was the highest for any month since January 1947, the beginning of the 1947-49 base period for the index. Although there were some price declines for fresh and frozen processed fishery products, they were almost completely offset by the higher ex-vessel prices for fresh unprocessed fish because of continued light landings. The July edible fish and shellfish (fresh, frozen, and canned) wholesale price index (131.2 percent of the 1947-49 average) dropped only 0.2 percent from the previous month's record high level, but was 9.4 percent higher than for the same month of 1957.

Continued light landings, particularly in the New England and Middle Atlantic area, were responsible for the record high prices in July for drawn, dressed, and whole finfish. During the summer prices are generally low because landings are usually heavy. Increases in ex-vessel prices for fresh large drawn haddock at Boston (up 8.2 percent) and wholesale prices for fresh large and medium king salmon and yellow pike (up 27.2 percent) at New York City more than offset a substantial drop in whitefish wholesale prices at New York City. Compared with July 1957, this July's prices were up for fresh large haddock by 38.1



Iced domestic and Canadian fresh-water fish stacked up inside a wholesale fish house in the Chicago Fulton Market area.

percent, for fresh Western halibut by 8.1 percent, for fresh king salmon by 20.4 percent, and for whitefish by about 13.7 percent. The drawn, dressed, or whole finfish subgroup index this July was 2.6 percent higher than the previous month and 23.3 percent above July 1957.

The light haddock landings were reflected in higher prices this July for fresh haddock fillets at Boston--up 8.2 percent from the previous month and 33.9 percent from the same month in 1957. The increase in fresh haddock fillets and shucked oyster prices was more than offset by a drop of 4.3 percent in July's fresh shrimp prices at New York. Compared with July 1957, prices this July for fresh haddock fillets were up 33.9 percent and for fresh large shrimp were up 4.2 percent. The index for the fresh processed fish and shellfish subgroup dropped 1.3 percent from June to July but was 5.4 percent higher than in the same month of 1957.

A drop in the prices for frozen shrimp at Chicago of 4.5 percent and for frozen ocean perch fillets more than offset

a 3.1-percent rise in the prices of frozen haddock fillets from June to July. Compared to July a year ago, prices this July for frozen haddock fillets were 26.4 percent higher and for frozen ocean perch fillets were 5.5 percent higher. On the other hand, frozen shrimp prices were 2.8 percent lower and flounder fillets also slightly lower. The July index for the processed frozen fish and shellfish subgroup was 2.4 percent lower than the previous month, but 5.7 percent higher than in the same month a year ago.

There was only a slight drop in the prices of canned fishery products from June to July because of slightly lower prices for California sardines (as dealers started to clean up their stocks for the beginning of the new season) and slightly lower prices for Maine sardines. When compared with a year ago, this July's prices for canned tuna were up 4.0 percent, for California sardine up 25.0 percent, and for Maine sardines were up 3.7 percent. This July's canned fishery products subgroup index was almost the same as a month earlier, but 3.8 percent higher than in July 1957.

Table 1 - Wholesale Average Prices and Indexes for Edible Fish and Shellfish, July 1958 With Comparisons

Group, Subgroup, and Item Specification	Point of Pricing	Unit	Avg. Prices ^{1/} (\$)			Indexes (1947-49=100)			
			July 1958	June 1958	July 1958	June 1958	May 1958	July 1957	
ALL FISH & SHELLFISH (Fresh, Frozen, & Canned)					131.2	131.5	128.6	119.9	
Fresh & Frozen Fishery Products:					150.0	150.4	146.0	133.3	
Drawn, Dressed, or Whole Finfish:					151.0	147.2	148.3	122.5	
Haddock, lge., offshore, drawn, fresh	Boston	lb.	.13	.12	131.6	121.6	101.7	95.3	
Halibut, West., 20/80 lbs., drsd., fresh or froz.	New York	lb.	.40	.40	123.8	123.8	106.7	114.5	
Salmon, king, lge. & med., drsd., fresh or froz.	New York	lb.	.75	.75	169.1	168.5	179.8	140.5	
Whitefish, L. Superior, drawn, fresh	Chicago	lb.	.54	.54	132.6	132.6	190.9	130.2	
Whitefish, L. Erie pound or gill net, rnd., fresh	New York	lb.	.63	.70	126.4	141.6	202.2	111.2	
Yellow pike, L. Michigan & Huron, rnd., fresh .	New York	lb.	.70	.55	164.1	129.0	111.4	164.1	
Processed, Fresh (Fish & Shellfish):					149.4	151.3	142.7	141.7	
Fillets, haddock, sml., skins on, 20-lb. tins . .	Boston	lb.	.40	.37	134.4	124.2	122.5	100.4	
Shrimp, lge. (26-30 count), headless, fresh . .	New York	lb.	.99	1.04	156.4	163.5	150.1	150.1	
Oysters, shucked, standards	Norfolk	gal.	5.75	5.63	142.3	139.2	136.1	142.3	
Processed, Frozen (Fish & Shellfish):					136.3	139.7	134.1	129.0	
Fillets: Flounder, skinless, 1-lb. pkg.	Boston	lb.	.40	.40	103.4	103.4	103.4	102.1	
Haddock, sml., skins on, 1-lb. pkg.	Boston	lb.	.34	.33	105.2	102.0	106.7	83.2	
Ocean perch, skins on, 1-lb. pkg.	Boston	lb.	.29	.29	114.8	116.8	118.8	108.8	
Shrimp, lge. (26-30 count), 5-lb. pkg.	Chicago	lb.	.94	.99	145.1	152.0	140.0	149.3	
Canned Fishery Products:					104.6	104.7	104.3	100.8	
Salmon, pink, No. 1 tall (16 oz.), 48 cans/cs. . .	Seattle	cs.	23.00	23.00	120.0	120.0	120.0	120.0	
Tuna, lt. meat, chunk, No. 1/2 tuna (6-1/2 oz.),									
48 cans/cs.	Los Angeles	cs.	11.65	11.65	84.0	84.0	84.0	80.8	
Sardines, Calif., tom. pack, No. 1 oval (15 oz.),									
24 cans/cs.	Los Angeles	cs.	5.63	5.68	131.3	132.4	132.4	105.0	
Sardines, Maine, keyless oil, No. 1/4 drawn									
(3-3/4 oz.), 100 cans/cs.	New York	cs.	7.72	7.75	82.2	82.5	79.8	79.3	

^{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.

