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DEEP-WATER TRAWLING SURVEY OFF THE COAST OF WASHINGTON (AUGUST 27 - OCTOBER 19, 1951)

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INTRODUCTION

The first in a planned series of exploratory fishing cruises intended to ascertain the bottom-fish varieties available and the commercial possibilities of otter trawling in the deeper ocean waters of the Pacific Northwest, beyond the present range of the region's trawl fishery, was made in the late summer and fall of this year by the U. S. Fish and Wildlife Service's exploratory fishing vessel John N. Cobb. Exploratory fishing was conducted off the Washington coast between latitudes 47°40' N. and 48°40' N., and extending 55 miles seaward. Roughly, the area covered is between Destruction Island and the northern portion of Swiftsure Bank (see figure 2). The vessel left Seattle on August 27 and returned on October 19, 1951. During the eight weeks of operations, 61 drags were made at depths ranging from 80 to 530 fathoms. Biologists from the Washington State Department of Fisheries and the University of Washington participated in the collection of data and also tagged some of the fish which were taken.

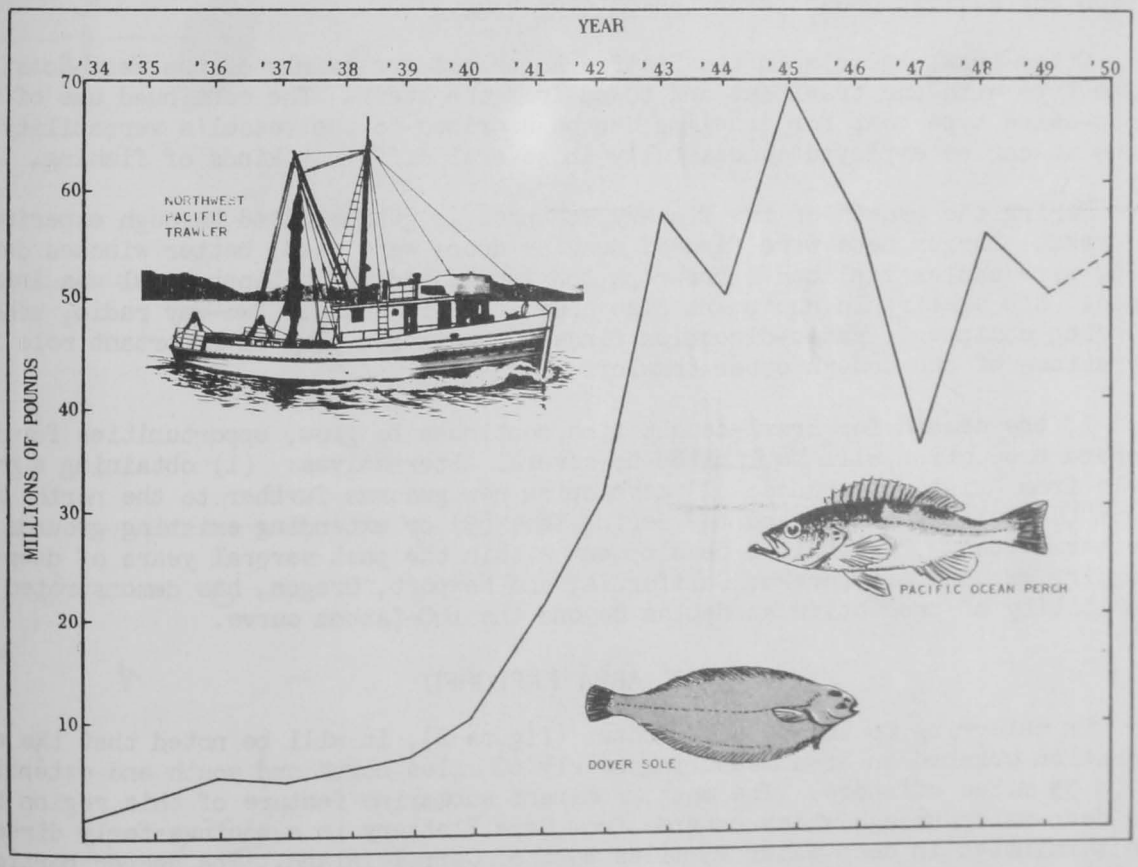

FIG. 1 - COMBINED OTTER-TRAWL LANDINGS OF FOOD FISH FOR WASHINGTON AND OREGON, 1934-1950.

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BRIEF HISTORY OF THE NORTH PACIFIC OTTER-TRAWL FISHERY

The offshore otter-trawl fishery of the Pacific Northwest began slightly over a decade ago. Since that time the fishery has skyrocketed in production and has become one of the major fisheries of the region (see figure 1). In a ten-year period, landings by the trawl fleets of Washington and Oregon multiplied 190 times (Anonymous 1944). U. S. Fish and Wildlife Service statistics show that an all-time high of approximately 70 million pounds of trawl-caught food fish were landed in 1945. This rapid growth of the fishery was principally the result of technological improvements in handling the product, the heavy demand for fishery products during the war years and the ability of the fishermen to produce large quantities of bottom fish at low cost.

In the early stages of the otter-trawl fishery, "drag boats" fishing off the Washington coast confined their operations to the waters between Destruction Island and Cape Flattery (Cleaver 1949). By 1938 the Grays Harbor region, as well as the Swiftsure and the La Perouse Banks, were being fished. During the ensuing years, the fishery spread along the west coast of Vancouver Island, and finally north to Hecate Straits. By 1948 the Washington trawl fleet was reported (Cleaver and Parker 1948) to number close to 200 vessels. This fleet fished waters ranging from the Columbia River to the northern Hecate Straits. The Oregon trawl fishery began somewhat later than that of Washington; however, a similar rapid growth occurred in that State's fishery.

In general, trawl fishing off the Washington and the Oregon coasts has been limited to depths shallower than 100 fathoms, although during the past several years, some trawlers have been fishing at depths between 100 and 200 fathoms off central Oregon for Pacific ocean perch (Sebastodes alutus).

Otter-trawl vessels in the Pacific Northwest are mainly of the West-Coast purse-seine type with the trawl set and towed from the stern. The continued use of the purse-seine type boat for trawling can be ascribed to the vessel's versatility, since it can be employed successfully in several different kinds of fishing.

During the growth of the fishery, changes in gear evolved through experience and need. Larger nets were fished, heavier doors were used, better winches developed, wire cables replaced fiber-rope tow lines, and the balloon trawl was introduced. New electronic equipment also aided the fisherman. Two-way radio, echo-sounding equipment, radio-direction finders, and loran play an important role in operations of the modern otter trawlers.

If the demand for trawl-caught fish continues to grow, opportunities for increased production will be limited to several alternatives: (1) obtaining a greater yield from existing grounds; (2) developing new grounds further to the north, such as in the Gulf of Alaska and the Bering Sea; (3) or extending existing grounds to greater depths. The limited development within the past several years of deep-dragging grounds off Eureka, California, and Newport, Oregon, has demonstrated the feasibility of production at depths beyond the 100-fathom curve.

THE AREA EXPLORED

In referring to the detailed chart (figure 2), it will be noted that the exploration covered an area measuring nearly 60 miles north and south and extending up to 55 miles offshore. The most prominent submarine feature of this region is the deep-water trough which extends from Cape Flattery in a southwesterly direction and terminates in deep water 25 miles west of Carrol Island. The deeper portions of this trough have a depth range from 150 to 200 fathoms. South of the trough,

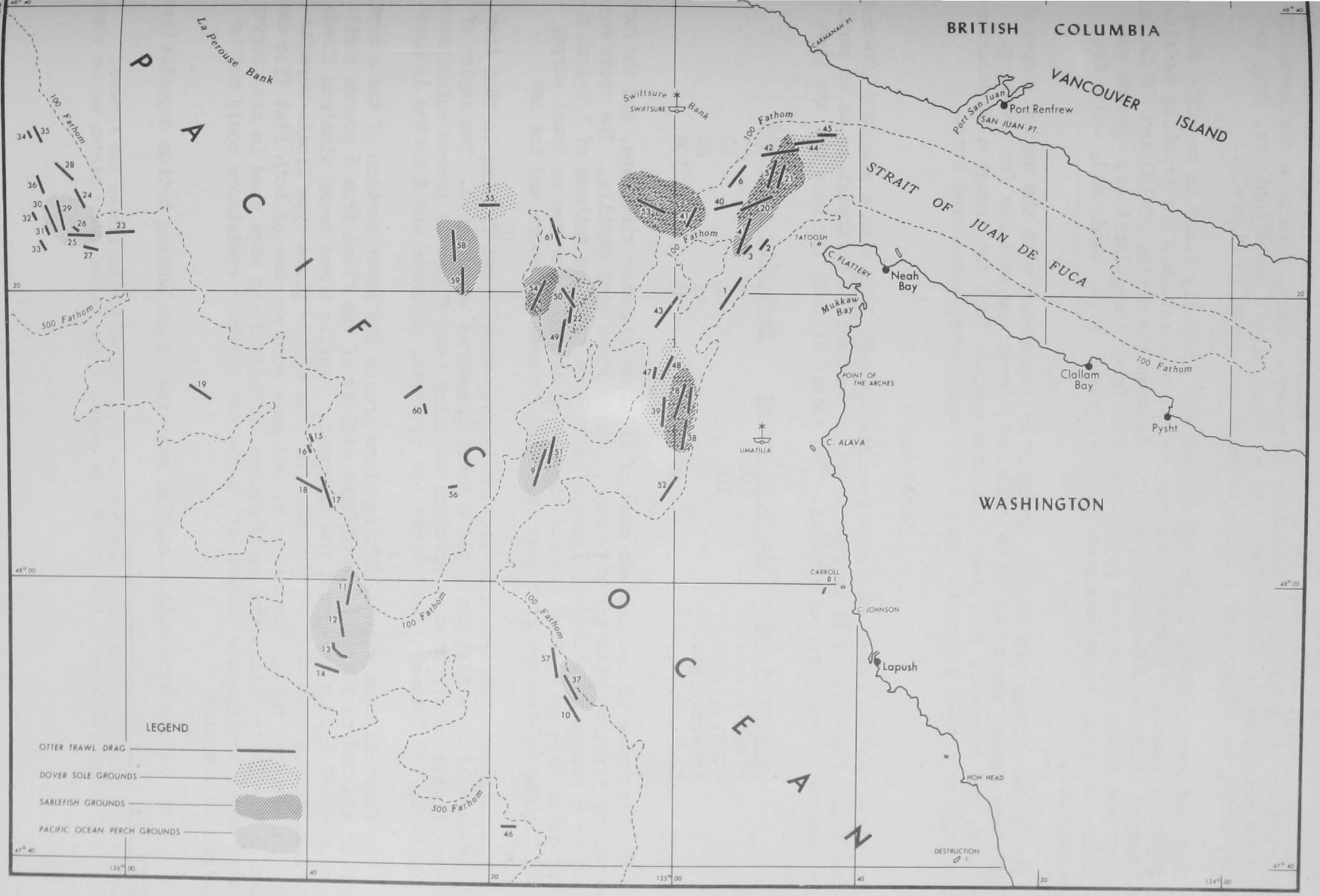


FIG. 2 - EXPLORATORY DRAGS, AREAS OF SPECIAL FISHING INTEREST, AND BOTTOM CONTOURS.

the continental shelf[1] extends offshore for approximately 20 miles before the steeper continental slope[2] begins. To the north and west of the trough, the continental shelf broadens and extends approximately 50 miles seaward, forming a shallower offshore bank sometimes locally referred to as "the spit." Depth contours, drag locations, and areas of special fishing interest are shown in figure 2.

The continental slope below 200 fathoms was generally found to be quite steep and broken by numerous submarine canyons. Few areas suitable for trawling were located deeper than the 200-fathom contour. Between the depths of 100 and 200 fathoms, the slope was found to be more gentle and with fewer irregularities. Bottom samples collected from the entire area included gravel, rock, sand, mud, and a few large boulders.

The bottom topography of the "trough," as contrasted with the abrupt slopes of the offshore banks, was found to be relatively level and suitable for trawling. Clay, mud, and sand were prevalent in bottom samples from the trough with occasional showings of gravel and rock. Only a few snags were encountered here.

GEAR USED

All exploratory drags were made from the John N. Cobb with a standard 400-mesh Western trawl (see figure 3) in common use in the Pacific Northwest so as to permit ready commercial appraisal of results. The specifications for this net are given below:

Section of Net	Length in meshes	Mesh size	Thread
Wings.....	100	4¼	42
Body.....	100	4¼	42
Intermediate.	75	4¼	60
Cod end.....	50	3½	108

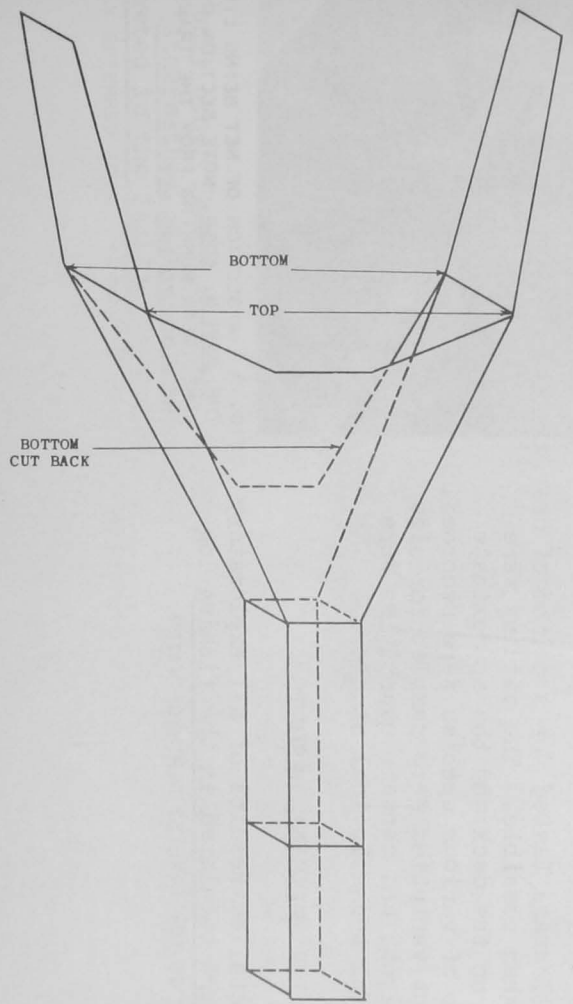
The head rope of the net was made of 1/2-inch diameter wire rope, and the foot rope was of 5/8-inch diameter wire rope, both wrapped with manilla. The doors were 4 feet by 8 feet and weighed 850 pounds each. One thousand fathoms of 1/2-inch diameter cable were carried on each of the two winch drums for use as trawl warps, and 20 fathoms of "dandy-line" gear were used between the doors and the net.

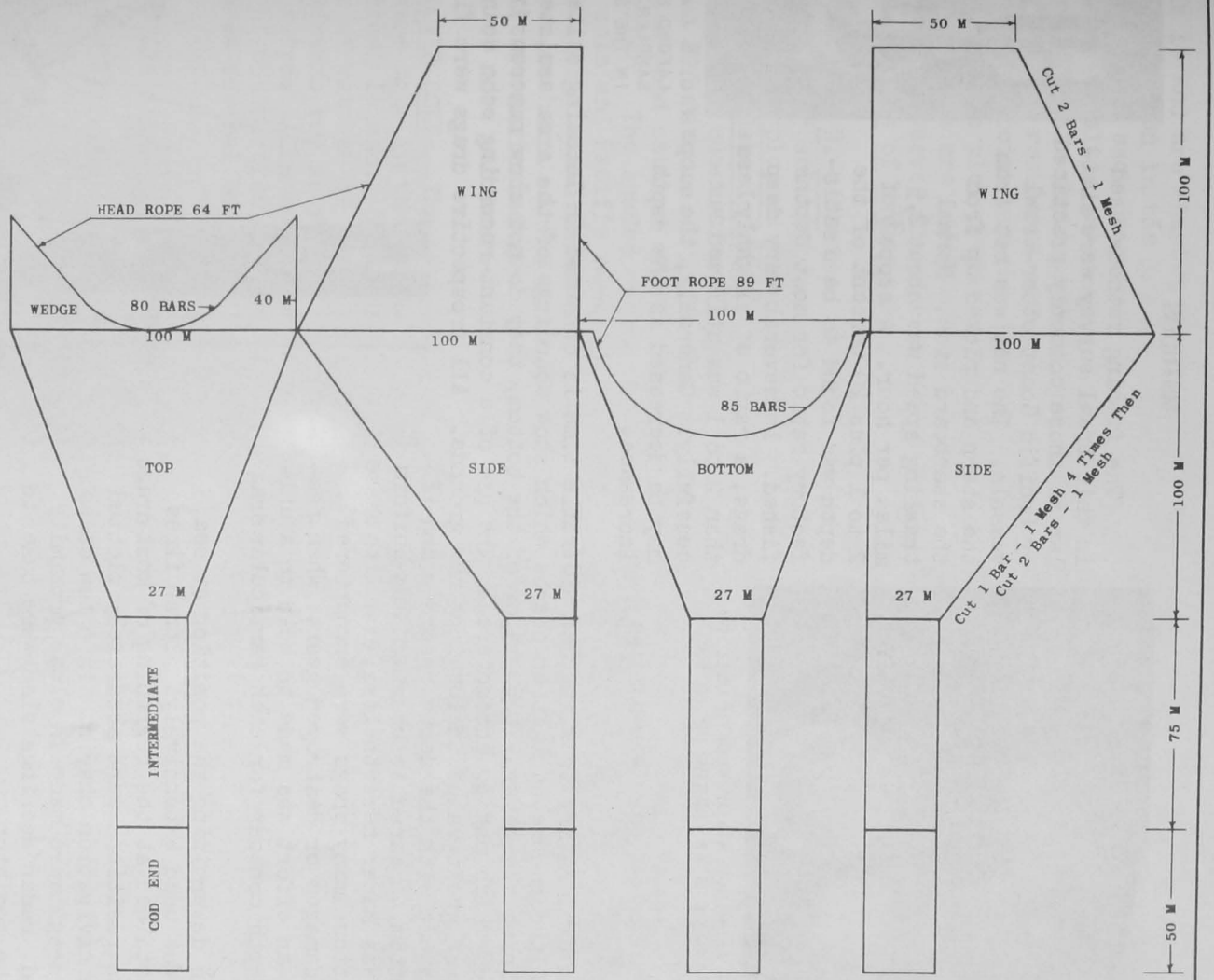
Floats present a particular problem in deep-water trawl fishing in that they must be capable of withstanding the extreme pressures encountered. Two styles of deep-sea floats constructed of an aluminum alloy (see figure 4) proved satisfactory at depths to 530 fathoms. Both types are spherical in shape and 8 inches in diameter.

One float is made with a lifting plane around the lower portion of the sphere, which is claimed to increase the lifting ability of the float from 6 pounds static bouyancy to 30 pounds at normal towing speed. Usually three round aluminum floats were fastened to each wing of the net, and four of the plane-type floats were fastened to the head rope. The net so rigged gave good catches of both flat fish and round fish. These floats are manufactured in England and were used in this survey because domestically-made floats with a similar pressure resistance could not be obtained at the time.

A Dietz-LaFond-type bottom sampler was used in collecting bottom deposits (see figure 5).

1/ ACTUALLY TERRACED REGIONS ALONG THE CONTINENT WITH DEPTHS NOT EXCEEDING 100 FATHOMS.
2/ THE SLOPES LEADING FROM THE EDGE OF THE CONTINENTAL SHELF TO THE GREAT DEPTHS OF THE OCEAN.





WINGS, TOP, BOTTOM, AND SIDES ARE 42-THREAD, 4 1/4" COTTON WEBBING.

INTERMEDIATE IS 60-THREAD, 4 1/4" COTTON WEBBING.

COD END IS 108-THREAD, 3 1/2" COTTON WEBBING.

(ALL MESH SIZES GIVEN ARE STRETCHED MEASUREMENT).

FIG. 3 - 400-MESH WESTERN OTTER TRAWL USED BY THE JOHN N. COBB.

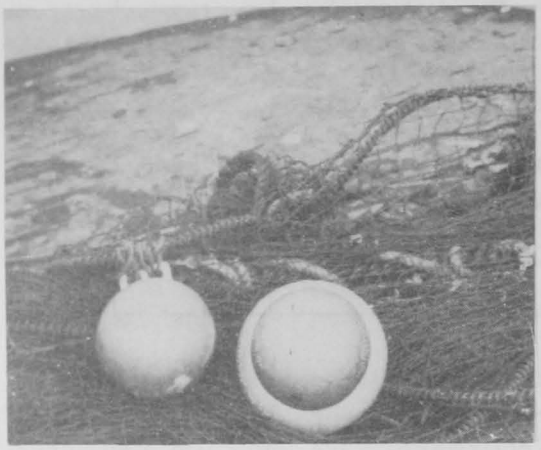


FIG. 4 - ALUMINUM ALLOY FLOATS USED ON THE TRAWL NETS AT DEPTHS UP TO 530 FATHOMS.
LEFT - SPHERICAL FLOAT.
RIGHT- SPHERICAL FLOAT WITH LIFTING PLANE.

METHODS

The fishing methods used in this trawl survey were similar to those commonly practiced by Pacific Coast otter-trawl vessels. The net was set from the stern and picked up from the starboard side. Normal trawling speed was about 2.5 miles per hour. A scope[3] of 2 to 1 plus 20 percent of the depth was found to be a satisfactory ratio for most depths fished. In several very deep drags, a ratio of slightly less than 2 to 1 was utilized successfully. Generally, the scope may be decreased as the depth increases.

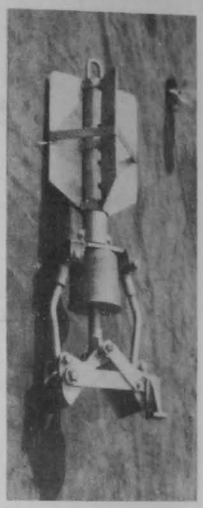


FIG. 5 - A DIETZ LAFOND BOTTOM SAMPLER USED IN THE SURVEY

In exploratory trawling, considerable time is consumed in locating suitable bottom. Although the navigation charts which show soundings of the area assisted in determining the general topography of the bottom, they do not show numerous irregularities which may be encountered. The use of a constant-recording echo sounder proved of great value in locating new grounds. All prospective drags were first sounded out with the depth recorder and if the bottom appeared to be relatively uniform a set was made; nevertheless, even with these precautions many snags were encountered which damaged or destroyed gear. When feasible, an effort was made to hold to a uniform depth contour for each particular drag.

In determining the position at sea, loran was used extensively. Loran fixes were obtained at the beginning of most drags and the positions were accurately plotted on the navigation charts. In a few cases where drags were made in close proximity to land, radar bearings also were taken to plot the position.

All drags lasted for a period of one hour, when possible. The catches were sorted on the deck and the approximate weights of various species were recorded. Dominant varieties were sampled for size and weight, and certain quantities were saved for technological studies.

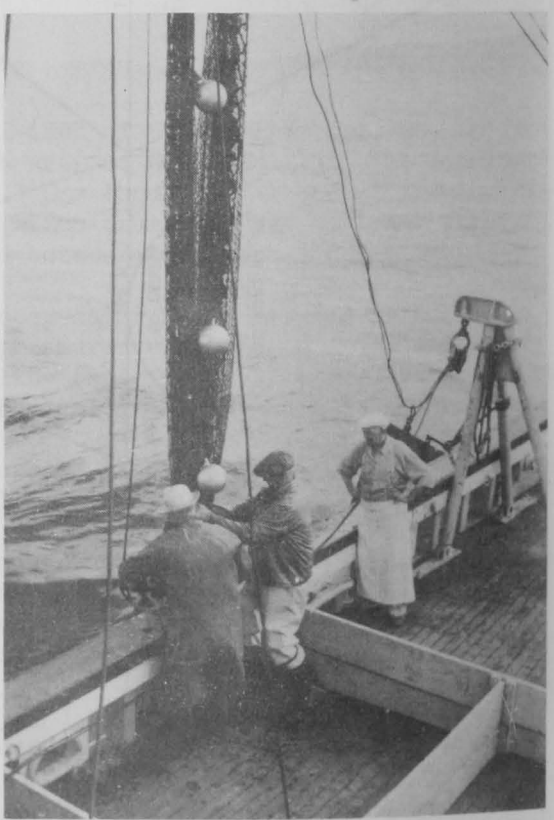


FIG. 6 - A SECTION OF NET BEING LIFTED ABOARD THE JOHN N. COBB. NOTE SECTION OF "DANDY-LINE" GEAR RUNNING FROM THE TRAWL DOOR THRU THE BLOCK TO THE NET.

FISHING RESULTS

Detailed results of all exploratory drags are tabulated in the fishing log

3/RATIO OF TOW LINE TO DEPTH OF WATER.

(table 1) and are charted in figure 2. The positions given in the log are the starting points of each drag. As it was often necessary to alter the course of a drag to follow a certain depth contour, the courses given are the resultant direction between the starting point and the end point of each drag. To plot drags given in the table, readers are referred to U.S. Coast and Geodetic Survey Chart 6102, Approaches to the Straits of Juan de Fuca.

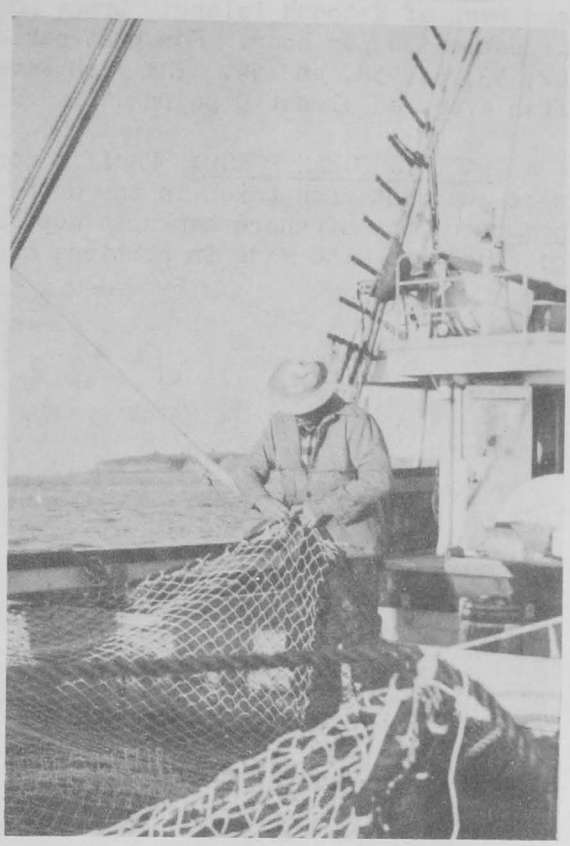


FIG. 7 - MENDING THE NET. EXPLORING NEW GROUNDS RESULTS IN FREQUENT DAMAGE TO GEAR.

The John N. Cobb found three species of fish, Dover sole (Microstomus pacificus), sablefish (Anoplopoma fimbria), Pacific ocean perch (Sebastodes alutus) available in commercial quantities at depths between 100 and 225 fathoms. Figure 2 shows areas in which good catches of the three species were taken. The shaded regions outlining Dover sole and Pacific ocean perch fishing grounds yielded catches of 1,000 pounds or more per hour. Areas where sablefish grounds are indicated gave catches of 500 pounds or more per hour.

DOVER SOLE: The best hauls of Dover sole were made in the trough north and west of Tatoosh Island. This area yielded a number of catches of Dover sole exceeding 1,000 pounds per hour, and one drag produced 3,200 pounds. The bottom in this region was clear of obstruction and composed of mud, clay, sand, and some gravel. South of this area several bad snags were encountered on drags 2 and 3.

FIG. 8 - A GOOD CATCH OF BOTTOM FISH BEING SORTED.

Good catches of Dover sole, up to 3,000 pounds per hour, were also made in the trough from Point of the Arches south to Cape Alava. The bottom in this region was generally clear. For best Dover sole catches, see drags 8, 20, 21, 22, 38, 39, 41, 44, 45, 48, 51, 53, 55, and 57 in the fishing log.

The Dover sole taken were of good commercial size. A random sample of 200 fish ranged from 13 to 25 inches in length, with the average being slightly over 18 inches.

The only other flat fish taken in considerable quantity were the arrow-toothed flounder (Atheresthes stomias)[4/] and the rex sole (Glyptocephalus zachirus), not generally marketed in the Pacific Northwest.

4/ COMMONLY REFERRED TO AS "TURBOT" BY MANY NORTHWEST FISHERMEN.

SABLEFISH: The best catches of sablefish were also made in the trough north and west of Tatoosh Island. Drags in this region yielded from 500 to 2,500 pounds of sablefish per hour. For best sablefish catches, see drags 4, 5, 8, 20, 38, 41, 42, 53, 54, 58, and 59. The fish were of good commercial size, and a sample of 162 fish averaged almost 9 pounds.

PACIFIC OCEAN PERCH: Pacific ocean perch were by far the most common and the most abundant fish taken in the deep-water trawl work. This species was especially common on the offshore banks at depths from 125-220 fathoms; however, many good catches were also made in portions of the trough. Probably the best prospective fishing grounds discovered for these fish were on the continental slope, approximately 35 miles west of Cape Johnson. Drags in this region gave catches ranging from 1,000 to 5,000 pounds per hour of Pacific ocean perch. The bottom in this area was mostly clear of obstructions although several large tears in the net were made in drag number 13 at depths from 216 to 225 fathoms.

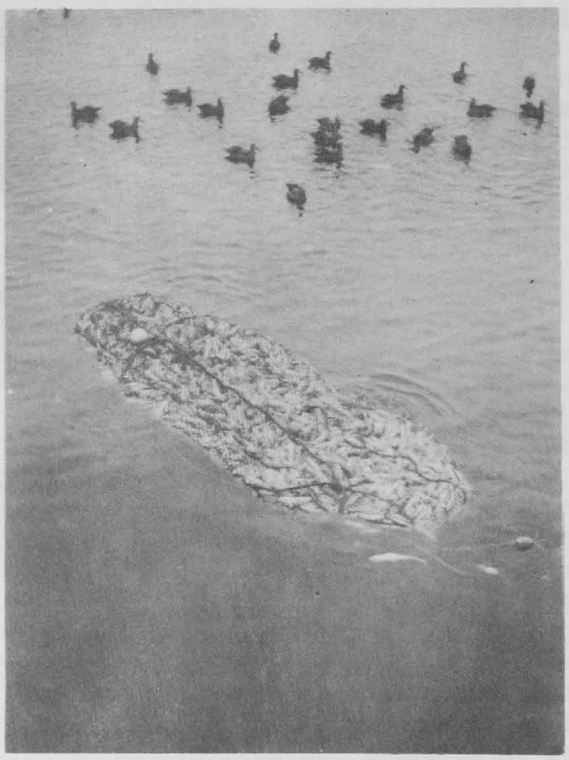


FIG. 9 - A LARGE "FLOATER" (FULL LOAD IN THE COD END) OF PACIFIC OCEAN PERCH BEING HAULED IN, ACCOMPANIED BY THE EVER-PRESENT FLOCK OF ALBATROSS OR "GOONIES."

Another region where several excellent catches of Pacific ocean perch were made was about 55 miles due west of Cape Flattery; however, for the majority of drags made, the bottom in this area was not found adaptable for trawling. Many snags were encountered and several large boulders were caught in the net (see figure 10). A considerable amount of gear was lost in this region. For best Pacific ocean perch catches, see drags 9, 11, 12, 13, 22, 25, 29, 30, 37, 49, and 54 in the fishing log. A random sample of 202 Pacific ocean perch averaged close to 15 inches in length and weighed over 2 pounds per fish.

Many species of rockfish were taken in smaller amounts along with the catches of Pacific ocean perch. Four varieties commonly caught included split-nosed rockfish (Sebastodes diploproa), rosy rockfish (Sebastodes rosaceus), black-mouthed rockfish (Sebastodes crameri), and round-finned rockfish (Sebastolobus alascanus).[5/] A catch of approximately 1,000 pounds of large black-throated rockfish (Sebastodes introniger) were taken in drag number 13, which averaged nearly 18 pounds per fish.

TRASH FISH

Trash fish including long-nosed skate (Raja rhina), and black skate (Raja kincaidii), dogfish (Squalus suckleyi), ratfish (Hydrolagus colliei), and hake (Merluccius productus), were commonly taken in the trough and at times dominated the catches. The offshore banks contained a much smaller percentage of trash fish, and most hauls there were quite clean.

5/ COMMON NAMES OF ROCKFISH ARE NOT WELL ESTABLISHED IN THE LITERATURE, AND MUCH VARIATION IN TERMINOLOGY EXISTS. COMMON NAMES USED HEREIN ARE THOSE CONSIDERED TO BE MOST DESCRIPTIVE AS DESIGNATED BY PACIFIC COAST AUTHORITIES.

FIG. 10 - A LARGE BOULDER PICKED UP 55 MILES WEST OF CAPE FLATTERY. ONE OF THE HAZARDS TO GEAR ENCOUNTERED IN EXPLORING NEW BOTTOM.

FIG. 11 - A CATCH OF PACIFIC OCEAN PERCH AND OTHER ROCKFISH.

SUMMARY

From August 27 to October 19, 1951, the Fish and Wildlife Service exploratory fishing vessel John N. Cobb conducted a survey of potential otter-trawling grounds off the coast of Washington at depths up to 530 fathoms. The work was done beyond the depth range of the present fishery, with the purpose of determining to what extent commercial fishing could be expanded into the deeper waters.

Offshore banks between 200- and the 500-fathom contours were generally found to have steep slopes and numerous canyons. Little trawling ground was located at these depths. The bottom at depths between 100 and 200 fathoms had slopes which were more gentle and with fewer irregularities. The bottom characteristics of the deep trough running southwest from Cape Flattery were generally suitable for trawling, and this area is considered the most promising of the regions explored.

Three varieties of fish were found in commercial abundance at depths between 100 and 225 fathoms. These included the Dover sole, the sablefish, and the Pacific ocean perch. Dover sole and sablefish were most abundant in the trough while Pacific ocean perch were taken both in the trough and on offshore banks. Trash fish were abundant in drags made in the trough, but were not common on the offshore banks.

A scope of 2 to 1 plus 20 percent of the depth was found satisfactory for most deep-water hauls. Good catches of trawl fish were generally located at depths between 100 and 225 fathoms. Five hundred fathoms of trawl wire for each warp should be sufficient to work these grounds.

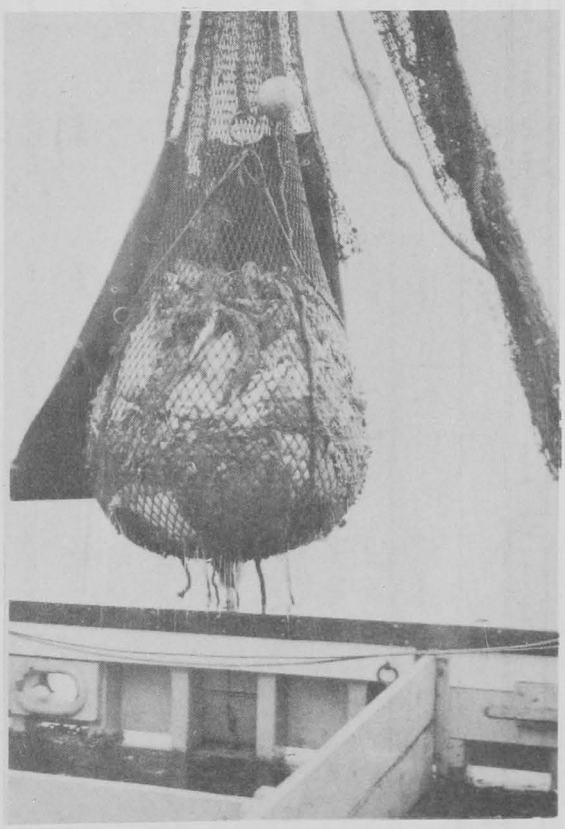


FIG. 12 - A HAUL OF FISH IN COD END OF THE TRAWL. NOTE HEAVY RUBBER CHAFING GEAR USED TO PROTECT WEB OF NET FROM ABRASIVE BOTTOM.

Table 1 - Fishing Log - Deep-Water Trawling Survey off the Coast of Washington (August 27 to October 19, 1951)

DRAG NUMBER	1	2	3	4	5	6	7	8	9	10
Date	8-28-51	8-28-51	8-29-51	8-29-51	8-29-51	8-29-51	8-30-51	8-30-51	8-30-51	8-31-51
Latitude N.	48° 18.7'	48° 23.7'	48° 22.7'	48° 22.8'	48° 29.2'	48° 28.7'	48° 13.5'	48° 13.8'	48° 08.8'	47° 51.8'
Longitude W.	124° 55.1'	124° 50'	124° 52.5'	124° 53'	124° 48'	124° 52.4'	124° 58.1'	124° 58.7'	125° 14.2'	125° 11.8'
Loran Reading	2H4-4287	2H4-4295	2H4-4283	2H4-4287	2H4-4299	2H4-4292	(Radar)	(Radar)	2H4-4243	2H4-4221
Loran Reading	2H5-2715	2H5-2691	2H5-2694	2H5-2687	2H5-2644	2H5-2631	(Radar)	(Radar)	2H5-2743	2H5-2906
Sea	Calm	Calm	Calm	Calm	Calm	Calm	Moderate	Moderate	Calm	Calm
Course, Magnetic	015°	180°	001°	000°	170°	195°	170°	182°	195°	150°
Depth Range in Fathoms	148-160	144	178-180	178-182	140-160	100-124	120-124	140-145	146-170	152-194
Type of Bottom	Gy. Cl.	Gy. M.	M. & Rky.	Gy. M.	G. & M.	Rky.	Gy. M.	M.	S.	G. & M.
Trawling Bottom	Clear	Snag	Snag	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Elapsed Time of Set	1 hr. 38 min.	1 hr. 25 min.	37 min.	1 hr. 43 min.	1 hr. 20 min.	1 hr. 20 min.	2 hrs. 5 min.	1 hr. 20 min.	1 hr. 16 min.	1 hr. 18 min.
Elapsed Time on Bottom	50 min.	48 min.	12 min.	1 hr.	1 hr.	1 hr.	1 hr.	1 hr.	55 min.	56 min.
Estimated Total Catch in Pounds	1200	800	20	3600	1800	(Crossed doors)	800	5500	4000	200
Splits	----	----	----	----	----	----	----	1	1	----
Catch in Pounds (% Marketable):										
Flat Fish:										
Dover	655 (90%)	200 (90%)	15 (100%)	800 (95%)	400 (95%)	----	150 (100%)	3000 (90%)	300 (80%)	50 (80%)
English	----	----	----	----	----	----	----	----	----	----
Petrale	----	----	----	(1)* (100%)	----	----	----	----	(1)* (100%)	----
Rex	(5)* (100%)	----	----	----	----	----	Few (100%)	300 (90%)	100 (80%)	Few (100%)
Turbot	100 (90%)	80 (100%)	----	100 (100%)	300 (100%)	----	75 (100%)	500 (100%)	200 (100%)	----
Round Fish:										
Hake	----	Few (100%)	----	700 (100%)	500 (100%)	----	Few (100%)	----	50 (100%)	----
Ling Cod	----	----	----	----	----	----	----	----	(1)* (100%)	----
Pollock	----	(1)* (100%)	----	Few (100%)	25 (100%)	----	----	Few (100%)	----	----
Sablefish	75 (100%)	350 (100%)	5 (100%)	1400 (95%)	600 (90%)	----	250 (70%)	600 (65%)	200 (80%)	75 (80%)
Shark	----	(1)* (100%)	----	----	----	----	Few (100%)	Few (100%)	Few (100%)	----
True Cod	----	----	----	----	----	----	----	----	----	----
Rockfish:										
Black	----	----	----	----	----	----	----	----	----	----
Pacific Ocean Perch	300 (95%)	50 (100%)	----	40 (75%)	150 (95%)	----	100 (100%)	500 (90%)	3000 (85%)	30 (95%)
Red	35 (75%)	60 (75%)	----	Few (100%)	170 (100%)	----	16 (100%)	200 (90%)	100 (100%)	----

* BRACKETED FIGURES INDICATE NUMBER OF FISH INSTEAD OF POUNDS.

Table 1 - Fishing Log - Deep-Water Trawling Survey off the Coast of Washington (August 27 to October 19, 1951) (Contd.)

DRAG NUMBER	11	12	13	14	15	16	17	18	19	20
Date	8-31-51	9-1-51	9-1-51	9-1-51	9-2-51	9-2-51	9-2-51	9-3-51-	9-3-51	9-9-51
Latitude N.	48° 00.5'	47° 58.2'	47° 54.5'	47° 53.3'	48° 10'	48° 09'	48° 04.8'	48° 06'	48° 13.5'	48° 25.8'
Longitude W.	125° 35'	125° 36.5'	125° 35.4'	125° 36.3'	125° 39.6'	125° 39.5'	125° 37.3'	125° 38.6'	125° 52.8'	124° 52.8'
Loran Reading	2H4-4175	2H4-4164	2H4-4157	2H4-4152	2H4-4185	2H4-4184	2H4-4181	2H4-4176	2H4-4159	2H4-4295
Loran Reading	2H5-2707	2H5-2737	2H5-2738	2H5-2760	2H5-2590	2H5-2599	2H5-2648	2H5-2613	2H5-2493	2H5-2678
Sea	Calm	Calm	Calm	Calm	Calm	Calm	Calm	Moderate	Mod. Chop.	Slight
Course, Magnetic	150°	146°	290°	265°	305°	305°	316°	272°	280°	067°
Depth Range in Fathoms	104-124	146-150	216-225	300-305	100	102	100	100-123	248-298	159-176
Type of Bottom	G.	G. & Sh.	G.	Rky.	Rky.	Rky.	Rky.	Rky.	Rky.	Gy. Cl.
Trawling Bottom	Clear	Clear	Snag	Snag	Snag	Snag	Clear	Clear	Snag	Clear
Elapsed Time of Set	1 hr. 28 min.	1 hr. 20 min.	1 hr. 31 min.	1 hr. 50 min.	19 min.	23 min.	1 hr. 23 min.	1 hr. 18 min.	5 hr. 50 min.	1 hr. 14 min.
Elapsed Time on Bottom	1 hr.	1 hr.	1 hr.	1 hr.	7 min.	5 min.	1 hr.	1 hr.	44 min.	56 min.
Estimated Total Catch in Pounds	1500	5200	6500	50	(Hung up)	(Hung up)	15 (Crossed doors)	1000	(Gear fouled)	5000
Splits	----	2	2	----	----	----	----	----	----	2
Catch in Pounds (% Marketable):										
Flat Fish:										
Dover	300 (80%)	200 (80%)	100 (80%)	15 (85%)	----	----	Few (80%)	200 (80%)	Few (40%)	3200 (95%)
English	----	----	----	----	----	----	----	----	----	----
Petrale	(1)* (100%)	(1)* (100%)	30 (95%)	----	----	----	Few (90%)	----	----	----
Rex	Few (100%)	Few (50%)	Few (50%)	----	----	----	Few (0%)	Few (50%)	----	----
Turbot	Few (100%)	Few (100%)	Few (100%)	----	----	----	----	150 (85%)	----	300 (100%)
Round Fish:										
Hake	----	Few (100%)	Few (100%)	(1)*(100%)	----	----	----	----	----	Few (100%)
Ling Cod	Few (100%)	----	----	----	----	----	----	----	----	----
Pollock	----	----	----	----	----	----	----	----	----	Few (100%)
Shark	----	----	----	----	----	----	----	----	----	Few (100%)
Sablefish	100 (90%)	250 (80%)	100 (85%)	90 (90%)	----	----	----	60 (65%)	----	750 (95%)
True Cod	40 (100%)	----	----	----	----	----	----	----	----	----
Rockfish:										
Black	25 (100%)	Few (100%)	----	----	----	----	----	----	----	----
Pacific Ocean Perch	1000 (90%)	3800 (95%)	9000 (95%)	----	----	----	(1)* (100%)	----	----	----
Red	100 (90%)	750 (20%)	1100 (95%)	Few (50%)	----	----	10 (0%)	300 (0%)	----	Few (100%)

*BRACKETED FIGURES INDICATE NUMBER OF FISH INSTEAD OF POUNDS.

Table 1 - Fishing Log - Deep-Water Trawling Survey off the Coast of Washington (August 27 to October 19, 1951) (Contd.)

DRAG NUMBER	21	22	23	24	25	26	27	28	29	30
Date	9-9-51	9-11-51	9-13-51	9-13-51	9-13-51	9-14-51	9-14-51	9-14-51	9-14-51	9-15-51
Latitude N.	48° 28.8'	48° 18.4'	48° 23.8'	48° 27'	48° 24'	48° 24.3'	48° 22.8'	48° 28.8'	48° 26.2'	48° 25.5'
Longitude W.	124° 48'	125° 11.2'	126° 01.8'	126° 05'	126° 05.8'	126° 05'	126° 04.1'	126° 07.2'	126° 07'	126° 08'
Loran Reading	2H4-4291	(Radar)	2H4-4166	2H4-4161	2H4-4158	2H4-4153	2H4-4156	2H4-4162	2H4-4152	2H4-4150
Loran Reading	2H5-2652	(Radar)	2H5-2357	2H5-2310	2H5-2335	2H5-2333	2H5-2349	2H5-2282	2H5-2315	2H5-2319
Sea	Moderate	Calm	Large swell	Large swell	Heavy swell	Moderate swell	Moderate swell	Light swell	Light swell	Calm
Course, Magnetic	176°	009°	060°	128°	093°	270°	090°	107°	143°	135°
Depth Range in Fathoms	144-160	104-108	104-122	110	124-128	140	146-154	112	128-132	149-151
Type of Bottom	G.	Gy. M.	G.	G. & S.	G.	G.	Rky.	Rky.	G.	G.
Trawling Bottom	Clear	Clear	Clear	Snag	Clear	Snag	Snag	Snag	Clear	Clear
Elapsed Time of Set	1 hr. 27 min.	1 hr. 17 min.	1 hr. 25 min.	1 hr. 5 min.	1 hr. 25 min.	25 min.	55 min.	1 hr. 27 min.	1 hr. 20 min.	1 hr. 30 min.
Elapsed Time on Bottom	1 hr.	1 hr.	1 hr.	44 min.	1 hr.	4 min.	30 min.	1 hr.	1 hr.	1 hr.
Estimated Total Catch in Pounds	1800	3600	2500	1000	2500	Hung up	800	1000	2800	5000
Splits	----	----	1	----	----	----	----	----	1	3
Catch in Pounds (% Marketable):										
Flat Fish:										
Dover	1200 (95%)	1300 (90%)	800 (50%)	100 (50%)	300 (75%)	----	100 (50%)	100 (60%)	300 (55%)	150 (50%)
English	----	----	----	----	----	----	----	----	----	----
Petrale	----	----	(1)* (100%)	----	----	----	----	----	----	----
Rex	----	100 (50%)	Few (80%)	Few (10%)	50 (15%)	----	Few (80%)	Few (0%)	75 (20%)	----
Turbot	100 (100%)	400 (95%)	Few (80%)	Few (80%)	100 (80%)	----	Few (80%)	Few (50%)	----	100 (75%)
Round Fish:										
Hake	Few (100%)	75 (100%)	Few (100%)	Few (100%)	Few (100%)	----	----	50 (100%)	Few (100%)	Few (100%)
Ling Cod	(1)* (100%)	----	----	----	----	----	----	----	----	----
Pollock	Few (100%)	----	----	(1)* (100%)	(3)* (100%)	----	----	----	----	----
Sablefish	200 (100%)	(6)* (100%)	Few (100%)	Few (100%)	Few (50%)	----	----	----	Few (100%)	Few (0%)
Shark	Few (100%)	----	----	(1)* (100%)	----	----	----	----	----	----
True Cod	----	(1)* (100%)	----	50 (100%)	----	----	----	Few (100%)	Few (100%)	----
Rockfish:										
Black	----	----	----	----	----	----	----	----	----	----
Pacific Ocean Perch	----	1000 (95%)	500 (95%)	600 (100%)	1200 (75%)	----	500 (95%)	550 (75%)	1000 (84%)	4000 (80%)
Red	----	100 (90%)	500 (30%)	50 (60%)	300 (70%)	----	50 (50%)	150 (75%)	500 (70%)	500 (70%)

* BRACKETED FIGURES INDICATE NUMBER OF FISH INSTEAD OF POUNDS.

Table 1 - Fishing Log - Deep-Water Trawling Survey off the Coast of Washington (August 27 to October 19, 1951) (Contd.)

DRAG NUMBER	31	32	33	34	35	36	37	38	39	40
Date	9-15-51	9-15-51	9-15-51	9-16-51	9-16-51	9-16-51	9-18-51	9-19-51	9-19-51	9-20-51
Latitude N.	48° 24.2'	48° 25.2'	48° 23'	48° 31	48° 31.3'	48° 27.5'	47° 53.2'	48° 11.5'	48° 10.7'	48° 26.2'
Longitude W.	126° 08'	126° 09'	126° 08'	126° 09.8'	126° 09'	126° 09'	125° 12'	124° 58.6'	125° 01.3'	124° 52.2'
Loran Reading	2H4-4146	2H4-4146	2H4-4144	2H4-4158	2H4-4160	2H4-4153	2H4-4224	(Radar)	(Radar)	2H4-4290
Loran Reading	2H5-2307	2H5-2288	2H5-2320	2H5-2231	2H5-2230	2H5-2260	2H5-2888	(Radar)	(Radar)	2H5-2656
Sea	Calm	Calm	Calm	Calm	Calm	Calm	Hvy. swell	Large swell	Large swell	Hvy. swell
Course, Magnetic	140°	143°	308°	150°	138°	135°	129°	166°	358°	215°
Depth Range in Fathoms	171	106	200-202	106	104	140-142	104-112	120-126	142-160	132-138
Type of Bottom	G.	Rky.	Rky.	Rky.	Rky.	Rky.	G.	Gy. M.	G. & S.	Rky.
Trawling Bottom	Snag	Snag	Snag	Snag	Snag	Snag	Clear	Clear	Clear	Snag
Elapsed Time of Set	40 min.	35 min.	55 min.	19 min.	48 min.	1 hr. 5 min.	1 hr. 20 min.	1 hr. 22 min.	1 hr. 20 min.	1 hr. 15 min.
Elapsed Time on Bottom	14 min.	8 min.	20 min.	7 min.	32 min.	39 min.	1 hr.	1 hr.	1 hr.	53 min.
Estimated Total Catch in Pounds	1000	45	800	Hung up	400	500	3000	5000	3500	Hung up
Splits	----	----	----	----	----	----	----	2	1	----
Catch in Pounds (% Marketable):										
Flat Fish:										
Dover	Few (40%)	Few (50%)	Few (20%)	----	50 (70%)	50 (60%)	800 (70%)	2550 (85%)	1000 (50%)	----
English	----	----	----	----	----	----	----	(1)* (100%)	----	----
Petrale	Few (100%)	----	----	----	----	----	----	Few (100%)	----	----
Rex	Few (10%)	----	----	----	Few (50%)	Few (40%)	----	100 (15%)	200 (10%)	----
Turbot	100 (90%)	----	50 (100%)	----	----	----	300 (85%)	200 (80%)	500 (90%)	----
Round Fish:										
Hake	Few (100%)	Few (100%)	Few (100%)	----	----	----	Few (100%)	Few (100%)	100 (100%)	----
Ling Cod	----	----	----	----	----	----	----	----	----	----
Pollock	----	----	----	----	----	----	----	Few (50%)	50 (100%)	----
Sablefish	----	----	15 (100%)	----	8 (100%)	Few (100%)	100 (90%)	1000 (95%)	300 (100%)	----
Shark	----	----	----	----	----	----	----	100 (100%)	300 (100%)	----
True Cod	----	----	----	----	----	----	Few (100%)	----	----	----
Rockfish:										
Black	----	----	----	----	----	----	(1)* (100%)	----	100 (100%)	----
Pacific Ocean Perch	750 (90%)	30 (60%)	650 (75%)	----	200 (80%)	300 (75%)	1200 (95 %)	100 (95%)	100 (95%)	----
Red	100 (70%)	10 (0%)	50 (10%)	----	100 (75%)	100 (60%)	300 (65%)	200 (95%)	300 (100%)	----

* BRACKETED FIGURES INDICATE NUMBER OF FISH INSTEAD OF POUNDS.

Table 1 - Fishing Log - Deep-Water Trawling Survey off the Coast of Washington (August 27 to October 19, 1951) (Contd.)

DRAG NUMBER	41	42	43	44	45	46	47	48	49	50
Date	9-20-51	9-21-51	9-24-51	9-25-51	9-25-51	9-27-51	9-30-51	9-30-51	10-1-51	10-1-51
Latitude N.	48° 25.8'	48° 29.3'	48° 17.5'	48° 30.2'	48° 30.8'	47° 43'	48° 14.1'	48° 14'	48° 16'	48° 19'
Longitude W.	124° 57.6'	124° 50.6'	125° 01.8'	124° 47.2'	124° 42.6'	125° 17.2'	125° 02.2'	125° 01.8'	125° 12.2'	125° 11'
Loran Reading	(Radar)	(Radar)	(Radar)	(Radar)	(Radar)	2H4-4183	2H4-4271	2H4-4273	2H4-4254	2H4-4259
Loran Reading	(Radar)	(Radar)	(Radar)	(Radar)	(Radar)	2H5-2966	2H5-2733	2H5-2742	2H5-2671	2H5-2645
Sea	Slight Chop.	Calm	Moderate	Choppy	Choppy	Moderate	Moderate	Heavy swell	Moderate	Moderate
Course, Magnetic	182°	057°	012°	059°	214°	248°	346°	003°	348°	306°
Depth Range in Fathoms	140-148	122	102-118	120-124	110-112	520-530	168	172-184	105-112	100-102
Type of Bottom	Gy. M.	Gy. M.	Gy. M.	S.	G. & S.	M.	Rky.	Gy. Cl.	Gy. M.	M.
Trawling Bottom	Clear	Clear	Clear	Clear	Clear	Snag	Snag	Clear	Clear	Clear
Elapsed Time of Set	1 hr. 20 min.	1 hr. 31 min.	1 hr. 17 min.	1 hr. 26 min.	1 hr. 25 min.	1 hr. 45 min.	30 min.	1 hr. 35 min.	1 hr. 28 min.	1 hr. 16 min.
Elapsed Time on Bottom	1 hr.	1 hr. 9 min.	1 hr.	1 hr.	1 hr.	28 min.	4 min.	1 hr.	1 hr.	1 hr.
Estimated Total Catch in Pounds	2500	7000	2500	7000	3000	300	40 (Hung up)	2000	4000	2000
Splits	----	3	----	2	----	----	----	----	1	----
Catch in Pounds (% Marketable):										
Flat Fish:										
Dover	1000 (85%)	800 (90%)	500 (95%)	2000 (95%)	1500 (90%)	----	15 (100%)	1000 (95%)	100 (50%)	300 (70%)
English	----	Few (100%)	----	50 (100%)	Few (100%)	----	----	----	----	----
Petrale	----	----	----	----	----	----	----	----	----	----
Rex	100 (50%)	Few (100%)	Few (10%)	----	Few (10%)	----	----	----	Few (60%)	Few (10%)
Turbot	300 (95%)	2000 (90%)	300 (100%)	2000 (90%)	800 (100%)	----	----	200 (80%)	200 (100%)	300 (90%)
Round Fish:										
Hake	Few (100%)	Few (100%)	100 (100%)	Few (100%)	Few (100%)	----	----	Few (100%)	Few (100%)	Few (100%)
Ling Cod	----	----	----	----	----	----	----	----	Few (100%)	----
Pollock	Few (100%)	Few (100%)	Few (100%)	Few (100%)	----	----	----	----	----	Few (100%)
Sablefish	500 (100%)	2500 (95%)	200 (100%)	50 (100%)	100 (90%)	50 (80%)	----	100 (100%)	400 (100%)	100 (100%)
Shark	100 (100%)	200 (100%)	550 (100%)	1000 (100%)	300 (100%)	----	----	100 (100%)	Few (100%)	100 (100%)
True Cod	----	Few (100%)	----	----	----	----	----	----	Few (100%)	----
Rockfish:										
Black	----	----	----	----	----	----	----	----	----	----
Pacific Ocean Perch	50 (100%)	80 (100%)	100 (100%)	100 (100%)	50 (100%)	200 (35%)	----	75 (60%)	2800 (95%)	----
Red	50 (25%)	20 (75%)	Few (50%)	100 (10%)	50 (70%)	----	5 (0%)	Few (100%)	200 (95%)	50 (100%)

* BRACKETED FIGURES INDICATE NUMBER OF FISH INSTEAD OF POUNDS.

Table 1 - Fishing Log - Deep-Water Trawling Survey off the Coast of Washington (August 27 to October 19, 1951) (Contd.)

DRAG NUMBER	51	52	53	54	55	56	57	58	59	60	61
Date	10-4-51	10-4-51	10-9-51	10-9-51	10-9-51	10-10-51	10-10-51	10-15-51	10-15-51	10-15-51	10-16-51
Latitude N.	48° 08'	48° 06.5'	48° 25.5'	48° 18.5'	48° 25.5'	48° 06.3'	47° 53.3'	48° 22.1'	48° 21.6'	48° 12.2'	48° 23'
Longitude W.	125° 13.8'	124° 59.7'	125° 01.1'	125° 15.4'	125° 20.6'	125° 23.9'	125° 12.3'	125° 23.5'	125° 23'	125° 27.4'	125° 12.5'
Loran Reading	2H4-4243	2H4-4268	2H4-4280	2H4-4251	2H4-4247	2H4-4217	2H4-4223	2H4-4242	2H4-4239	2H4-4217	2H4-4260
Loran Reading	2H5-2739	2H5-2820	2H4-2624	2H5-2629	2H5-2530	2H5-2709	2H5-2890	2H5-2550	2H5-2558	2H5-2636	2H5-2591
Sea	Moderate	Calm	Calm	Calm	Calm	Slight Chop	Moderate	Rough	Moderate	Moderate	Moderate
Course, Magnetic	347°	192°	271°	071°	065°	240°	328°	330°	156°	141°	318°
Depth Range in Fathoms	142-148	170-180	98-100	100	98-100	60	102-118	98-102	81-83	60	97-108
Type of Bottom	Gr. M.	M.	M.	M. & G.	M.	Rky.	M. & G.	Gm. M.	M. & S.	Rky.	Gm. M.
Trawling Bottom	Clear	Clear	Clear	Clear	Clear	Snag	Clear	Clear	Clear	Snag	Clear
Elapsed Time of Set	1 hr. 22 min.	1 hr. 40 min.	1 hr. 18 min.	1 hr. 27 min.	1 hr. 25 min.	17 min.	1 hr. 18 min.	1 hr. 31 min.	1 hr. 15 min.	1 hr. 2 min.	1 hr. 15 min.
Elapsed Time on Bottom	1 hr.	1 hr.	1 hr.	1 hr.	1 hr.	5 min.	58 min.	1 hr.	1 hr.	23 min.	1 hr.
Estimated Total Catch in Pounds	2800	1200	4400	5200	4500	Hung up	3200	4000	3400	Hung up	5300
Splits	----	----	----	1	1	----	----	----	----	----	2
Catch in Pounds (% Marketable):											
Flat Fish:											
Dover	1000 (80%)	500 (50%)	1200 (90%)	500 (85%)	1000 (90%)	----	1000 (90%)	200 (80%)	500 (80%)	----	500 (75%)
English	----	----	----	----	----	----	----	----	----	----	----
Petrale	Few (100%)	----	----	Few (100%)	Few (100%)	----	Few (100%)	----	----	----	----
Rex	Few (15%)	100 (10%)	Few (10%)	Few (10%)	Few (10%)	----	Few (10%)	100 (15%)	500 (50%)	----	100 (15%)
Turbot	200 (50%)	200 (80%)	1200 (90%)	1500 (95%)	1500 (90%)	----	500 (95%)	1500 (90%)	1000 (80%)	----	2000 (90%)
Round Fish:											
Hake	Few (100%)	Few (100%)	300 (100%)	200 (100%)	Few (100%)	----	Few (100%)	----	----	----	Few (100%)
Ling Cod	----	----	100 (100%)	Few (100%)	----	----	Few (100%)	----	----	----	----
Pollock	Few (100%)	Few (100%)	Few (100%)	Few (100%)	Few (100%)	----	Few (100%)	Few(100%)	----	----	----
Sablefish	400 (100%)	100 (100%)	750 (80%)	600 (90%)	400 (90%)	----	400 (90%)	600 (95%)	500 (95%)	----	200 (100%)
Shark	Few (100%)	Few (100%)	200 (100%)	200 (100%)	300 (100%)	----	300 (100%)	800 (100%)	800 (100%)	----	800 (100%)
True Cod	----	----	Few (100%)	Few (100%)	Few (100%)	----	----	----	----	----	----
Rockfish:											
Black	----	----	----	----	----	----	----	----	25 (100%)	----	----
Pacific Ocean Perch	200 (60%)	----	275 (70%)	1600 (80%)	350 (80%)	----	700 (80%)	700 (75%)	200 (75%)	50 (75%)	1200 (80%)
Red	200 (90%)	100 (100%)	20 (100%)	400 (50%)	150 (80%)	----	100 (80%)	200 (85%)	50 (70%)	----	200 (80%)

*BRACKETED FIGURES INDICATE NUMBER OF FISH INSTEAD OF POUNDS.

As the investigation was confined to the period between August 27 and October 19, there may be variations from the results reported herein at other seasons of the year.

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U.S. CANNED FISHERY PRODUCTS PRODUCTION

That the pack of canned fishery products in the United States and Alaska in 1950 amounted to 965,357,608 pounds, valued at $330,362,853 to the packers. This was an increase of 13 percent in volume and 12 percent in value as compared with the 1949 production. These increases resulted principally from larger packs of tuna and California sardines (pilchards). Canned fishery products were packed in 455 plants in 21 States and Alaska during 1950.

That California led in the production of canned fishery products with a pack of 517,045,017 pounds, valued at $140,251,694. Alaska was second with 158,294,861 pounds, valued at $82,828,503. These areas accounted for 70 percent of the volume of the 1950 pack and 68 percent of its value.

WEST COAST CANNERY

That the pack of tuna and tunalike fishes, which amounted to 9,016,541 cases (174,794,436 pounds), valued at $112,830,094, was 1,726,221 cases greater than the 1949 production. Canners received 15 million dollars more for the pack than in the previous year. The 1950 tuna pack was the sixth consecutive record pack of these fish.

That the 1950 pack of canned salmon amounted to 4,274,462 standard cases (205,174,176 pounds), valued at $108,590,571 to the canners. Compared with 1949, this was a decline of 23 percent in volume, but an increase of 5 percent in value. The pack was the third most valuable in history.

That the 1950 pack of California sardines (pilchards) amounted to 5,070,805 standard cases (228,186,225 pounds) valued at $26,345,609. Compared with the previous year, this was an increase of 35 percent in volume, and 23 percent in value. The 1950 pack was the largest in history.

Canned Fish & Byproducts--1950, C.F.S. No. 671