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SOUTHEASTERN ALASKA EXPLORATORY HERRING FISHING OPERATIONS, WINTER 1952/53

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SUMMARY

Explorations to determine the feasibility of winter herring fishing in Southeastern Alaska were conducted in the winter of 1952/53. Under a cooperative program between the U. S. Fish and Wildlife Service and the Alaska herring industry, the exploratory fishing vessel John N. Cobb explored the waters of Southeastern Alaska between November 4 and December 19, 1952. An amendment to the Alaska fishery regulations permitted the operation of four commercial herring seiners in the waters south of 55°N. latitude between November 9, 1952, and February 11, 1953.

With the exception of a few areas, herring were not found to be abundant during this period. The John N. Cobb did not find herring on the grounds customarily exploited by the summer fishery. Although indications of herring were obtained in Port Camden, Seymour Canal, George Inlet, Silver Bay, Tongass Narrows, and Kendrick Bay, only in the latter three localities were there indications of abundance. The catch of the commercial seiners was approximately 30,000 barrels, 68 percent of which came from Kendrick Bay. Catches were also made in McLean Arm, Foggy Bay, Nakat Bay, Boca de Quadra, and Yes Bay. The most significant concentration of herring was in Tongass Narrows, which was closed by regulation to fishing for reduction purposes.

Herring from Kendrick Bay (which provided the bulk of the catch) were small. Fairly large herring were obtained from the localities of Foggy Bay, Nakat Bay, and Boca de Quadra. The Tongass Narrows herring were of mixed size, averaging much larger than those of Kendrick Bay, but not equal in size to those of Nakat Bay.

Herring in their second year of life were predominant in the catch from Kendrick Bay. The Foggy Bay, Nakat Bay, and Boca de Quadra catches showed a greater spread of ages with a predominance of 3-year and 6-year fish. The Tongass Narrows fish were of mixed age, ranging from 1 to 6 years.

Laboratory analysis showed the winter herring to be approximately 13½ percent oil by weight. The oil yield of slightly less than 3 gallons per barrel of raw fish processed,

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which was obtained in the commercial operations, was less than the 5 gallons normally obtained in the summer operations. No increase in oil content was noted with increased age, as has been the experience in the summer catch.

During November and December, unusually mild weather prevailed in Southeastern Alaska. Interruptions to fishing by weather in the commercial operations amounted to 30 days, or roughly one-third of the operating period.

It was observed that in winter the herring tend to stay at much greater depths than in the summer period, which suggests that the use of deeper nets, such as employed in the Canadian fishery, may be nessary for successful winter fishing.

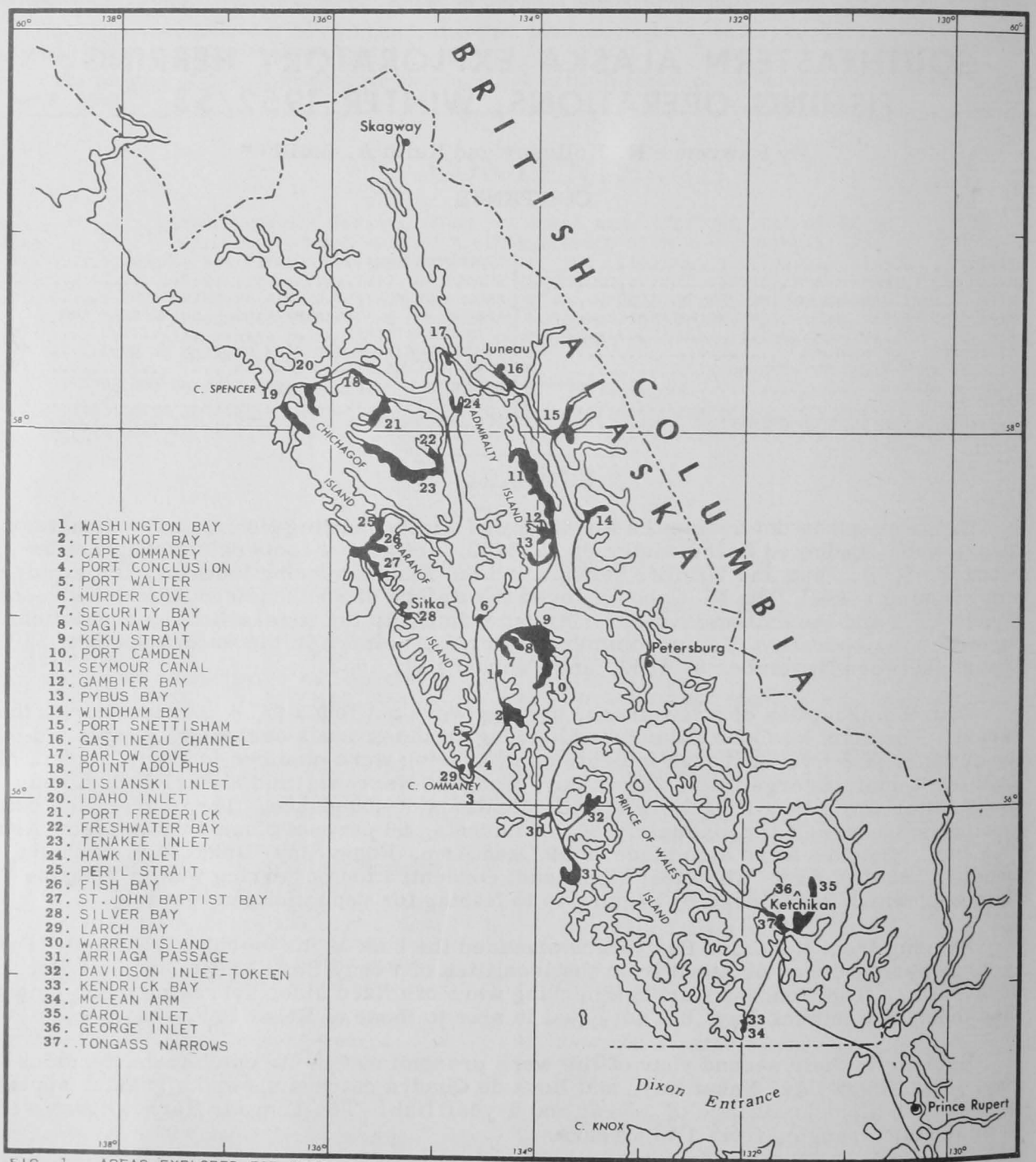

FIG. 1 - AREAS EXPLORED FOR HERRING BY JOHN N. COBB, SOUTHEASTERN ALASKA, WINTER 1952. LINES SHOW COURSES RUN WITH ECHO SOUNDER IN OPERATION.

A total of 5,397 herring were tagged with internal belly tags to determine if there is a southward migration of Southeastern Alaska herring into British Columbia. Eight recoveries have been made to date, but these recoveries have all come from the same locality in which the fish were tagged, and furnish no information on migration. The British Columbia fishery did not operate in the season of 1952/53, so that chances for recovery in that area have been lost for this season.

These explorations did not result in finding numerous concentrations of herring, but do not eliminate the possibility of developing a winter herring fishery in this area. Where herring were found, they were abundant, as shown by the high average catch per set of the commercial boats. Had the herring in Tongass Narrows been available to the fishery, the commercial operations would have been more successful. Tongass Narrows appears to be comparable to Ogden Channel in northern British Columbia as an assembly area of the prespawning schools. The Ogden Channel area contributed 480,000 barrels to the British Columbia herring catch in 1951/52. Whether the herring industry will venture further winter operations in Southeastern Alaska will depend on the market for fishery byproducts.

BACKGROUND INFORMATION

A matter of great interest to those concerned with the Alaska herring fishery has been the sustained high production in British Columbia contrasted to the recent low production in Southeastern Alaska. For the five-year period from 1948 through 1952, the catch in British Columbia has been approximately 11 times that of Southeastern Alaska.

British Columbia and Southeastern Alaska Herring Catches, 1947/48-1951/52 Seasons

British Columbia		Southeastern Alaska	
Season	Catch	Season	Catch
	Short Tons		Short Tons
1951/52	198,000	1952	17,600
1950/51	187,300	1951	14,100
1949/50	183,200	1950	15,700
1948/49	190,100	1949	17,700
1947/48	171,700	1948	18,700

Although fishing effort in British Columbia has exceeded that in Southeastern Alaska, this alone does not satisfactorily explain the marked difference in production. The poor catches in Southeastern have been caused primarily by a scarcity of herring resulting either from reduced abundance or reduced availability. Under these circumstances it is doubtful that any increase in fishing effort would have resulted in a marked improvement of the catch.

Because these areas are in adjacent geographical positions and presumably have similar conditions of environment, it would be natural to expect comparable productive capacity and at least similar patterns of abundance.

It has been suggested that the difference in production may be due to the difference in fishing season. British Columbia herring are fished from November to the middle of March; those of Alaska from June through September. British Columbia investigators believe that their major herring populations are offshore in summer and do not become available inshore until the prespawning runs of late fall and winter. This has been confirmed, at least insofar as one population is concerned, by exploratory catches made on Swiftsure Bank in July 1953. Tag recoveries revealed that these fish had been tagged during the spring spawning period in the inshore waters of Barkley Sound. Obviously, a summer fishery confined only to shore areas would have missed these fish entirely.

Similarly, an offshore movement by Alaska herring might cause these populations to escape the summer fishery which is conducted relatively close to shore. In this event the fluctuations in the summer catches might be influenced more by annual or cyclic variation in the offshore movements than by actual changes in abundance.

It has also been suggested that the declining yields in Southeastern Alaska coincident with increasing yields in British Columbia have been caused by changes in migratory pattern. Alaska fishermen have expressed the opinion that the Southeastern Alaska herring are now bypassing that area in favor of British Columbia waters. This theory presumes a southward migration of the Southeastern Alaska herring stocks.

In British Columbia in recent years the high production in the northern subdistrict has contributed materially to the success of the herring fishery. Following good yields (chiefly from the Prince Rupert area) in the period of 1937-1942, production in this sub-

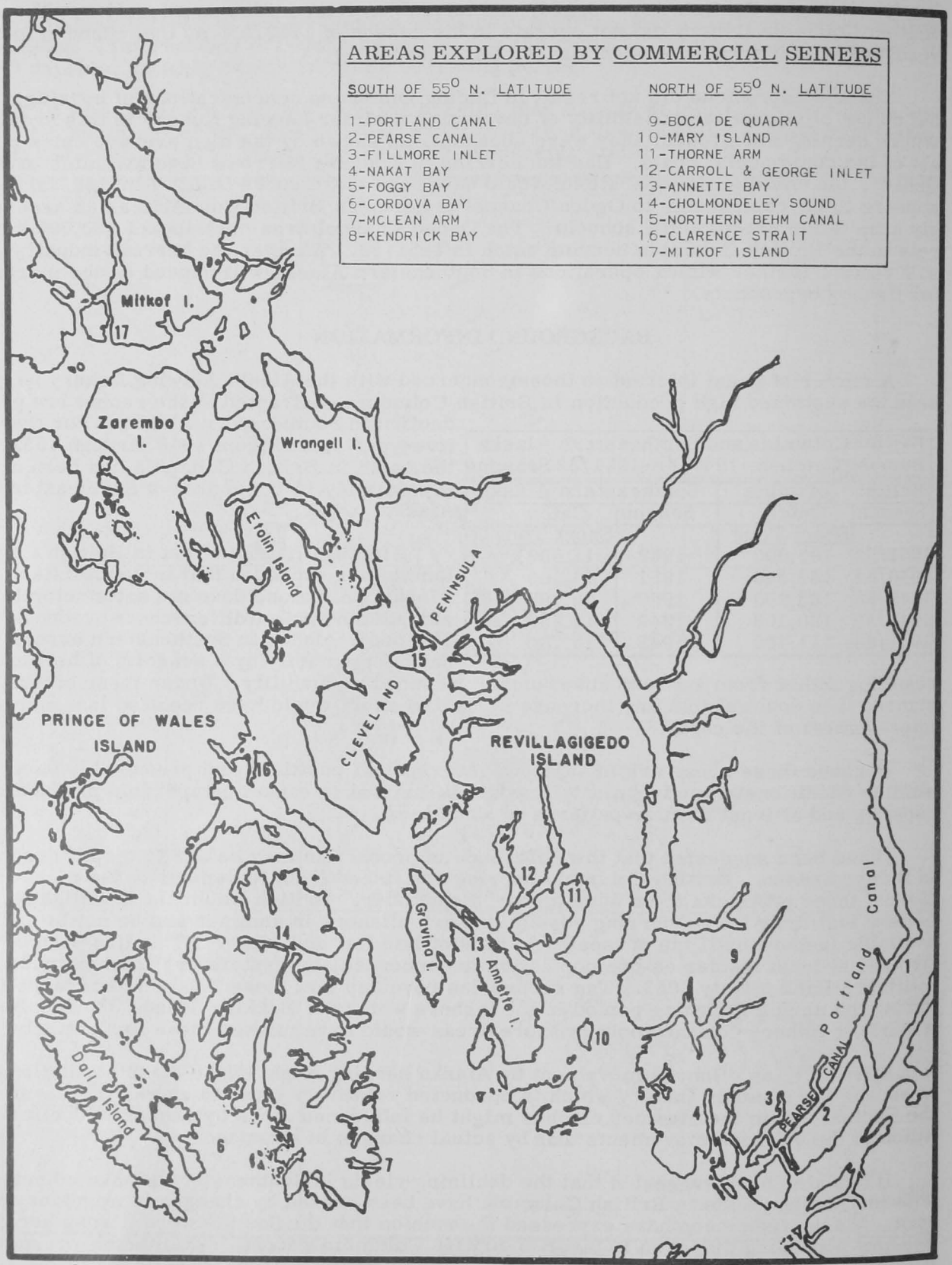

FIG. 2 - AREAS EXPLORED BY COMMERCIAL HERRING SEINERS, SOUTHEASTERN ALASKA, WINTER 1952/53.

district declined sharply in the period 1943-1948. With the discovery in the 1948/49 season of a large concentration of herring in Ogden Channel, the catch in this subdistrict has increased each year to a high of 57,300 tons in the 1951/52 season. The apparent abundance of herring in this subdistrict, which bounds on the international border, has aroused considerable speculation as to whether these stocks might not also be available to Alaskan fishermen in the Dixon Entrance area.

To determine if herring are sufficiently abundant in Southeastern Alaska during November and December to support reduction operations, the Service organized an exploratory fishing expedition in the fall of 1952. In planning these activities, it was proposed to tag herring to the extent that it would not seriously interfere with the exploratory work. The purpose was to determine if there is a southward movement of Alaska herring into British Columbia waters. It was decided to tag on the United States side of Dixon Entrance to see if any recoveries would be obtained from the British Columbia fishery during the ensuing winter period.

The exploratory expedition was sponsored jointly by the U. S. Fish and Wildlife Service and the Alaska herring industry. The Exploratory Fishing and Gear Development Section of the Service's Branch of Commercial Fisheries furnished the exploratory fishing vessel John N. Cobb. The Branch of Fishery Biology furnished biologists for tagging and the collection of biological data. The Alaska herring reduction operators furnished a purse seine and other items of fishing gear. The Alaska Department of Fisheries placed a biologist on board the John N. Cobb as an observer and to assist in tagging operations.

In the same period in which this expedition was being organized, a request was received from the industry to allow herring fishing for reduction purposes in the Dixon Entrance area. Favorable action on this request by the Service resulted in commercial fishing in waters south of 55° N. latitude during the winter of 1952/53.

The following report deals both with the explorations by the Service vessel John N. Cobb and fishing by commercial vessels since both operations furnish information on the availability of herring during the winter months.

SCOPE OF EXPLORATIONS OF THE JOHN N. COBB

The John N. Cobb operated between November 4 and December 19, 1952. The area explored extended from Dixon Entrance to Icy Strait, including Tongass Narrows, lower Clarence Strait, Sea Otter Sound, Chatham Strait, Frederick Sound, Seymour Canal, Stephens Passage, Peril Strait, and the south side of Icy Strait. (The daily log of the John N. Cobb is Appendix B.)

The gear employed was a standard Alaska herring purse seine 200 fathoms long. This seine was six strips deep, each strip consisting of 200 meshes of $1\frac{1}{2}$-inch stretched measure between knots. The maximum fishable depth of this seine was approximately 10 fathoms. In addition to the purse seine, a lampara bait seine was carried. (Details of modifications of the John N. Cobb required for purse-seine operation, net construction, and operation are contained in Appendix A.)

The echo sounder used in sounding for herring was a Bendix model DR-6. This instrument gives a choice of two depth ranges: 0 to 400 feet and 0 to 400 fathoms, and makes an instantaneous and permanent graphical record of bottom depth and also of objects between the ship and the bottom. When running over fish, the depth and extent of the school are indicated by the tracing on the recording tape. Instruments of this type are now universally used by herring seiners in Alaska, and are considered essential for locating herring schools.

An experienced herring seiner captain was employed to assist in locating herring schools and to supervise actual seining operations.

SCOPE OF EXPLORATIONS BY COMMERCIAL VESSELS

On October 10, 1952, the Service amended Section 116.3 of the 1952 Alaska Fishery Regulations by extending the established closure date of October 15 to February 28 of the following year. The new closure date applied only to the waters south of 55° N. latitude. Herring fishing in Tongass Narrows for reduction purposes was prohibited. The provision which allowed for a take of 2,000 bbls.[1/] per calendar month in the remainder of Southeastern Alaska was retained.

Two companies participated in the winter fishery: the Salmon By-Products Company located at Ketchikan, and the Oceanic Fisheries Company which operated the floating reduction barge Pacific Rim at Metlakahtla. Each company employed two large seiners with experienced herring fishermen and equipped with standard herring gear.

The Salmon By-Products Company was first in the field and began searching for herring with the seiners Storm and Fram on November 9. The Oceanic Fisheries Company did not begin actual fishing until December 10 with the seiners Oceanic and Vitanic. All fishing was terminated by February 11, 1953.

In the course of these operations, the vessels thoroughly scouted the waters south of 55° N. latitude and prospected to a lesser extent in areas north of that line. Inspection of logbooks kept by these vessels show that their explorations included the places indicated in figure 2.

RESULTS

OCCURRENCE OF HERRING: Except for a few localities, the findings of the John N. Cobb and the commercial vessels were largely negative. The localities in which herring were found by the John N. Cobb were Port Camden, Seymour Canal, Lisianski Inlet, Silver Bay, Kendrick Bay, George Inlet, and Tongass Narrows. Localities in which the commercial vessels succeeded in making catches were McLean Arm, Kendrick Bay, Foggy Bay, Nakat Bay, Boca de Quadra, and Northern Behm Canal (Yes Bay). Only in Silver Bay, Kendrick Bay, and Tongass Narrows were there indications of any real abundance.

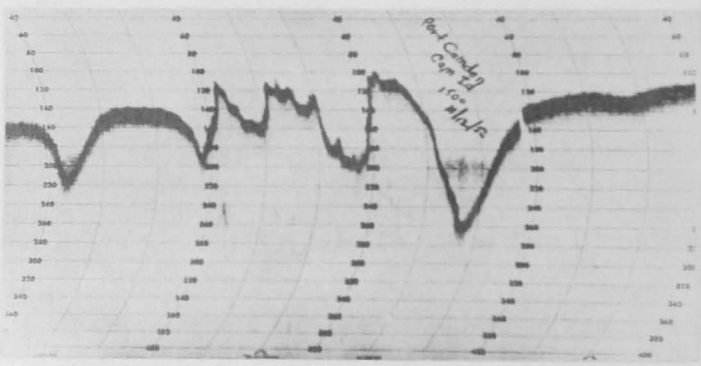

FIG. 3 - ECHO-SOUNDER TRACING OF HERRING SCHOOLS LYING IN BOTTOM DEPRESSIONS IN PORT CAMDEN, SOUTHEASTERN ALASKA, NOVEMBER 1952.

An investigation was made by the John N. Cobb of the principal fishing grounds commonly exploited during the summer fishery, namely Chatham Strait, Cape Ommaney, Larch Bay, Tobenkof Bay, Tyee, Point Adolphus, Warren Channel, and Noyes Island. For the most part these areas appeared to be devoid of herring, as indicated by the lack of birds and by the lack of depth-sounder tracings.

Port Camden was sounded by the John N. Cobb on November 12 and 13 (see figure 3). Several schools of herring which were lying in bottom depressions were too deep for capture by purse seine. At midnight a floodlight which was played on the water attracted some of these fish to the surface and two were caught by dip net.

Seymour Canal, sounded on November 13 and 14, contained two schools near the mouth of Pleasant Bay at depths of 20 to 80 feet.

Echo-sounder tracings were recorded in Lisianski Inlet on November 20 and 21. These schools, situated between Pelican City and Soloma Point, were not in suitable position for making a purse-seine set. Several moving brown spots were also observed

1/THE STANDARD HERRING BARREL CONTAINS 31.5 GALLONS AND HOLDS APPROXIMATELY 250 POUNDS OF FISH. EIGHT BARRELS ARE CONSIDERED EQUIVALENT TO ONE TON.

in the water and remained near the beach in a manner characteristic of small fish. Some of these fish caught by means of the "herring jig" proved to be juvenile rockfish (Sebastodes emphaeus).

Soundings in George Inlet on December 11 showed a small school of herring at a depth of approximately 200 feet near the site of the Libby Cannery dock.

A large concentration of herring was discovered at the entrance to Silver Bay by the John N. Cobb on December 1. The magnitude of this body of fish is demonstrated by the echo-sounder tracings obtained (figure 4). At midday these schools were at depths of 220 to 260 feet. At dusk, and with the appearance of a full moon, some of these fish rushed to the surface. The subsequent flipping which appeared to extend over at least a square mile of area sounded like the fall of large hailstones on the water.

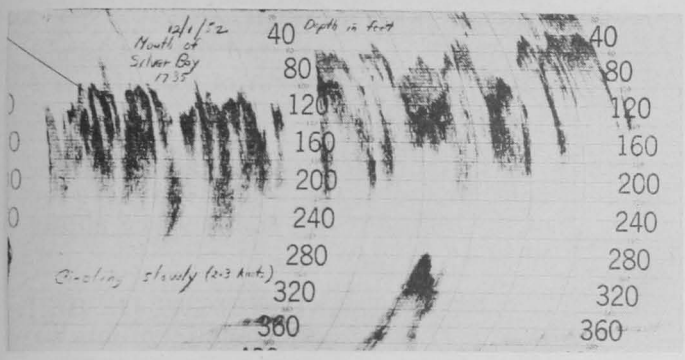

FIG. 4 - ECHO-SOUNDER TRACING OF HERRING SCHOOLS IN SILVER BAY, SOUTHEASTERN ALASKA, DECEMBER 1952.

The fishing captain judged these to be large fish by the sound of the flips. The set was unsuccessful because the fish sounded before the seine could be pursed, and the few small fish caught were obviously not representative of the main body of the school. It was anticipated that herring would be present in this area since it is the major herring spawning ground in Southeastern Alaska.

The most impressive showing of herring was in Tongass Narrows which contained an enormous body of herring throughout the winter months. It was reported by residents that the herring had first appeared in the Narrows in the latter part of October. On the John N. Cobb's first visit to this area on November 7, significant soundings were obtained at depths of 40 to 80 feet. On December 6 the John N. Cobb again sounded these waters and obtained the tracings shown in figure 5. On this date thousands of gulls and numerous sea lions were observed to be "working" on the herring schools. For about one hour following dusk the herring could be heard flipping at the surface over a wide area near the docks of Ketchikan.

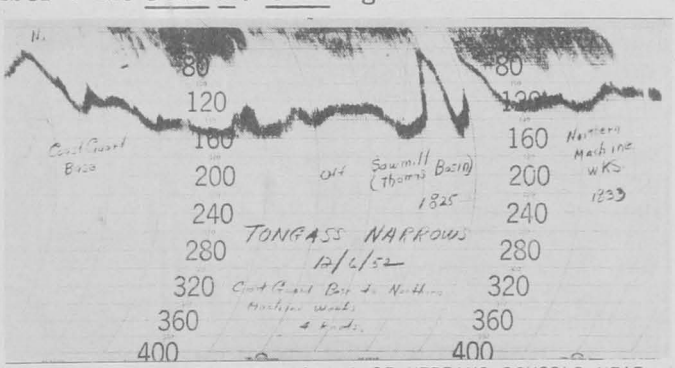

FIG. 5 - ECHO-SOUNDER TRACING OF HERRING SCHOOLS NEAR THE SURFACE IN TONGASS NARROWS, SOUTHEASTERN ALASKA, DECEMBER 1952.

The presence of large quantities of herring in Tongass Narrows is also substantiated by the echo soundings of the commercial vessels. Although these waters were closed to fishing for reduction purposes, the vessels frequently sounded them en route to and from the reduction plant. The tracings obtained were, in many instances, larger than those obtained by the John N. Cobb. All demonstrated a large mass of herring with both depth and width. The herring were mainly in the southern portion of the Narrows, extending from Potter Rock to the Ketchikan docks, a distance of approximately three miles. This concentration of herring was greater than any which the fishermen had previously observed during their experience in the summer fishery.

Approximately 15,000 barrels of herring were removed from Tongass Narrows during the winter of 1952/53 by the bait fishery.

The occurrence of herring in Kendrick Bay and McLean Arm on the southeast shore of Prince of Wales Island was established by the catch of approximately 20,000 barrels

by the commercial vessels. The fact that they commonly loaded their holds in a single set is evidence that the herring were densely schooled. A set made by the John N. Cobb in Kendrick Bay on the night of December 8 yielded a catch of approximately 1,500 barrels.

Table 1--Catch by Reduction Fishery, Southeastern Alaska, Winter 1952/1953

Date	Locality						Total
	McLean Arm	Kendrick Bay	Foggy Bay	Nakat Bay	Boca de Quadra	Northern Behm Canal	
	(In 250-pound barrels)						
Nov. 1952:							
15	500						500
28		886					886
29		1,039					1,039
Dec. 1952:							
2		1,157					1,157
5		1,026					1,026
8		1,126					1,126
10		1,034					1,034
14		798					798
15		871					871
16		1,067					1,067
17	973						973
18		2,044					2,044
19		314					314
22	510						510
23		193					193
26		1,111					1,111
27		779					779
30		1,373					1,373
31		901					901
Jan. 1953:							
3		373					373
5		1,529					1,529
6		931					931
17			1,115				1,115
20			1,109				1,109
21				1,443			1,443
22				1,061			1,061
23				2,013			2,013
24				1,089			1,089
28					1,081		1,081
Feb. 1953:							
5						831	831
Total	1,983	18,552	2,224	5,606	1,081	831	30,277

The commercial vessels also reported a fair showing of fish in Boca de Quadra. Because this locality lies north of 55° N. latitude, their catch was necessarily limited by the regulation which restricted the combined catch in waters north of this line to 2,000 barrels per calendar month.

Catches from other areas which contributed to the 30,000-barrel take of the commercial fishery are shown in table 1.

LENGTH AND WEIGHT OF HERRING: Two length measurements were taken from each fish. Body length, customarily used in measuring herring, is the distance from the tip of the snout to the end of the silvery area on the caudle peduncle after the scales have been removed from this area. Total length is the distance from the tip of the snout to the tip of the tail. Average lengths and weights are shown in table 2.

The data from Kendrick Bay in table 2 is of special interest since this locality provided the major part of the commercial catch. These fish, which averaged only 5.8 inches in body length and 1.3 ounces in weight, were small in contrast to those caught in all of Southeastern Alaska in the summer of 1952. The summer fish averaged 8.1 inches in body length and 4.3 ounces in weight.

Catches in Foggy Bay, Nakat Bay, and Boca de Quadra were a mixture of sizes averaging much larger than the uniformly small Kendrick Bay herring. The large Nakat Bay fish, with an average body length of 8.0 inches and an average weight of 4.2 ounces, compare favorably in size to those taken in the summer fishery.

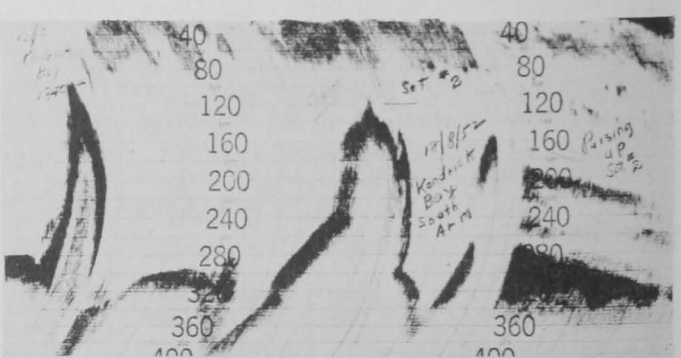

FIG. 6 - ECHO-SOUNDER TRACING OF HERRING SCHOOLS IN KENDRICK BAY, SOUTHEASTERN ALASKA, DECEMBER 1952.

Two samples of herring were obtained from Tongass Narrows. These samples show the Tongass Narrows fish to be of mixed sizes, considerably larger than the Kendrick Bay fish, but not equal to those of Nakat Bay. Body length averaged 7.2 inches and body weight averaged 3.0 ounces.

AGE OF HERRING: The age of the herring in all samples was obtained by examination of the scales on which an annulus or winter check is formed each year. A fish with two annuli on its scale is two years old and is so designated by Roman numeral "II." Such a fish is in its third year of life and so designated by Arabic figure "3." Year class signifies the year in which the fish was spawned. Thus, for example, a fish taken in December 1952 with two annuli on its scale would be II years old, in its 3rd year of life, and of the year class of 1950.

The marked difference in age composition of catches from McLean Arm and Kendrick Bay in lower Clarence Strait from those of Foggy Bay, Boca de Quadra, and Nakat Bay in lower Revillagigedo Channel, is apparent in figures 7 and 8. These localities are roughly 35 miles apart. The McLean Arm and Kendrick Bay samples are comprised almost exclusively of 2-year fish from the year class of 1951. The Foggy Bay, Boca

Table 2 - Average Lengths and Weights of Herring, Southeastern Alaska, Winter 1952/53.

Locality of Catch	Date	Boat	Fish in Sample	Avg. Body Length	Avg. Total Length	Avg. Weight
			Number	Inches	Inches	Ounces
Port Camden	11/12/52	Cobb 1/	2	4.65	5.49	0.74
Silver Bay	12/1/52	Cobb 2/	66	4.32	5.11	0.65
McLean Arm	12/22/52	Storm	50	5.76	6.81	1.32
Kendrick Bay	12/8/52	Fram	100	5.77	6.81	1.30
	12/9/52	Cobb	51	5.98	7.03	1.41
	12/14/52	Fram	50	5.87	6.88	1.37
	12/18/52	Fram	50	5.77	6.80	1.32
	12/23/52	Fram	50	5.71	6.76	1.29
	12/26/52	Vitanic	50	6.00	7.06	1.39
	12/30/52	Vitanic	54	5.76	6.87	1.32
	1/6/53	Oceanic	33	5.46	6.91	1.42
	Weighted average			5.80	6.90	1.34
Foggy Bay	1/17/53	Fram	50	7.24	8.47	2.82
	1/20/53	Storm	50	6.91	8.18	2.52
	Weighted average			7.08	8.33	2.67
Boca de Quadra	1/28/53	Storm	100	6.68	7.86	2.39
Nakat Bay	1/21/53	Oceanic	23	8.16	9.64	4.32
	1/21/53	Vitanic	15	7.35	8.71	3.20
	1/22/53	Oceanic	38	8.20	9.62	4.43
	Weighted average			8.02	9.44	4.15
Tongass Narrows	12/11/52	Pirate	126	7.26	8.52	3.09
	Dec.	Cold St.	100	7.17	8.44	2.91
	Weighted average			7.22	8.48	3.00
Tongass Narrows	12/15/52	Cobb 3/	50	5.37	6.37	0.90

1/CAPTURED BY DIP NET FROM FISH BROUGHT TO SURFACE BY FLOODLIGHT.
2/SAMPLE NOT REPRESENTATIVE BECAUSE SCHOOL SOUNDED AND THE ONLY FISH TAKEN WERE SMALL ONES WHICH HAD GILLED IN THE WEB.
3/CAPTURED WITH SHALLOW LAMPARA SEINE.

de Quadra, and Nakat Bay samples show a much greater spread in ages with a fair proportion of older fish. Most strongly represented in the latter samples are the 3-year fish of the year class of 1950 and the 6-year fish of the year class of 1947. The age composition of the Tongass Narrows herring is similar to that found in the lower Revillagigedo Channel district.

OIL CONTENT: The herring in each sample were segregated into age groups and each age group was ground separately. From the resulting mass a small sample was removed, and this was used for determination of the oil content of the particular age group concerned. The remaining portions of all age groups were then thoroughly mixed together. A small sample removed from this mass was used to determine the oil content of the sample as a whole. In samples consisting almost entirely of a single age, analysis was limited to this age only, under the assumption that it would adequately represent the sample as a whole. The oil content was determined by acid hydrolysis and extraction with ethyl ether and petroleum ether. The results of these determinations as expressed in percent of total weight are shown in table 4.

The recovery of 13.51 percent by weight from all samples analyzed is considerably greater than the recovery of approximately 9 percent achieved in the commercial operations. This is accounted for by the fact that separation by chemical means is more efficient than by the settling tank and centrifuge process used by the reduction plants. In

the winter fishery, the oil yield was slightly under 3 gallons per 250-pound barrel of raw fish processed as compared to an oil yield of 5 gallons per barrel normally obtained in the summer fishery.

A decrease in oil yield between the summer and winter fish was not unexpected since the fat accumulated during the summer feeding period is utilized in the development of sexual products during the late fall and winter. Hart, Tester, Beall, and Tully (1940) in their study of changes in the condition factor of British Columbia herring report that "a maximum oil content is reached in July and is fairly well sustained throughout the summer. In October the oil content starts to fall quite rapidly, reaching a very low value about spawning time in March." This pattern of seasonal oil change is also applicable to Southeastern Alaska herring.

Table 3--Age Composition of Herring Catches, Southeastern Alaska, Winter 1952/53

Locality of Catch	Year Class	1952	1951	1950	1949	1948	1947	1946	1945	1944	Total
	Year of Life	1	2	3	4	5	6	7	8	9	
McLean Arm	Number		49	1							50
	Percent		98.0	2.0							100
Kendrick Bay	Number		429	11	1	2	1				444
	Percent		96.6	2.5	0.2	0.5	0.2				100
Foggy Bay	Number		14	64	9	3	9	1			100
	Percent		14.0	64.0	9.0	3.0	9.0	1.0			100
Boca de Quadra	Number	1	18	55	12	5	9				100
	Percent	1.0	18.0	55.0	12.0	5.0	9.0				100
Nakat Bay	Number	1	2	22	6	14	27	2		2	76
	Percent	1.3	2.7	29.0	7.9	18.4	35.5	2.6		2.6	100
Tongass Narrows	Number	3	49	74	33	47	20				226
	Percent	1.3	21.7	32.7	14.6	20.8	8.9				100

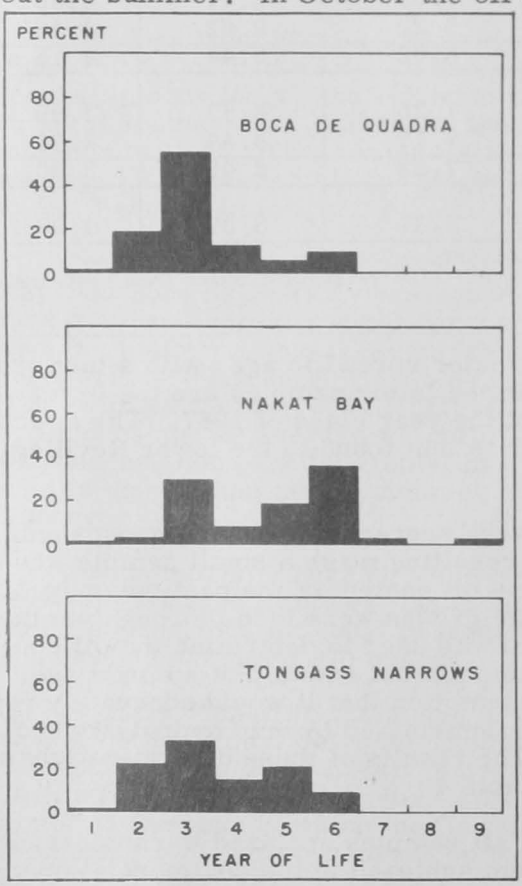

FIG. 7 - PERCENTAGE AGE COMPOSITION OF HERRING CATCHES, SOUTHEASTERN ALASKA, WINTER 1952/53.

Except for fish in their first year of life, these data show little difference in oil content with respect to age. This is somewhat surprising in view of studies 2/ made in 1942 of summer catches in the Kodiak Island district, which showed fish in their second year to be 7.7 percent, fish in their third year 16.4 percent, and fish in their fourth year 21.8 percent oil by weight. There appeared to be no significant increase in oil content beyond the fourth year. From this background a similar pattern was anticipated for the winter catches in Southeastern Alaska.

Failure to obtain such a pattern may be entirely due to the small number of samples in these determinations, or it may be possible that because the "belly fat" has been converted into milt or roe by midwinter, differences in oil content between herring of different ages is relatively slight. The high percentage of oil in the 2-year fish from Kendrick Bay might be explained by the fact that these were nearly all in their second year and sexually immature. In this group, individuals with developing gonads were extremely rare, indicating that the majority would not spawn in the following spring. Most, however, contained ester or "belly fat" in the body cavity, which was not usually present in fish which had developed spawning products.

2/ UNPUBLISHED DATA OF THE U. S. FISH AND WILDLIFE SERVICE.

WEATHER AND EFFECT ON OPERATIONS: During the period of survey by the John N. Cobb (November 9 to December 16), unusually mild weather prevailed over Southeastern Alaska. Daily air temperatures recorded by the John N. Cobb ranged from

Table 4--Oil Content (Expressed as Percent of Total Weight) of Herring Taken in Southeastern Alaska, Winter 1952/53

Date	Locality	Boat	Year of Life							
			1	2	3	4	5	6	7	Composite
12/1/52	Silver Bay	Cobb	7.65	11.01	13.01					11.22
12/22/52	McLean Arm	Storm		13.65						-
12/9/52	Kendrick Bay	Cobb		13.77						-
12/18/52	Kendrick Bay	Fram		13.37						13.30
12/23/52	Kendrick Bay	Fram		12.41						-
12/26/52	Kendrick Bay	Vitanic		13.05						-
1/17/53	Foggy Bay	Fram		10.63	12.80	13.23		11.59		14.65
1/20/53	Foggy Bay	Storm			14.59					13.03
1/28/53	Boca de Quadra	"		10.73	12.21	12.21	13.12	13.24		12.45
12/11/52	Tongass Narrows	Pirate			14.28	15.34	14.93	15.28	16.00	14.41
12/15/52	Tongass Narrows	Cobb	5.11	10.42						-
Dec. ?	Tongass Narrows	?			14.67	14.16	13.92	14.00		14.08
Weighted average, all samples			7.24	12.41	13.50	13.94	14.06	13.87	16.00	13.51

30° F. to 49° F., with an average of 40.5° F. Surface water temperatures ranged from 39° F. to 47° F., with the coldest waters at the heads of bays and inlets, and the warmest waters in the open coastal areas. Average surface temperature was 42.5° F. No ice was encountered at the heads of bays as would normally be expected at this time of year.

Four storms of gale force were experienced. The prevailing winds were southeasterly to southwesterly, moving warm air inward from the ocean areas. The outside waters were generally too rough for seining, which was also true of the exposed waters of Chatham Strait. It was concluded that any seining operations in that area would be subject to much loss of fishing time because of weather.

The commercial operations conducted between November 9 and February 11 included 94 days of fishing time. On 21 of these days the boats could not fish because of storms. This does not include the loss of an additional 9 days caused by a severe cold spell between January 5 and January 14 which caused the nets to freeze. Total interference to fishing operations amounted to 30 days, or approximately one-third of the total time. The cold spell caused ice to form in some of the smaller bays, including Kendrick Bay which had been the principal fishing ground up to that time.

HERRING BEHAVIOR, WINTER AND SUMMER: A noteworthy observation obtained from these experiments is the difference in behavior between the herring schools in the winter and summer seasons. In winter the herring appear to stay close to the bottom and generally at much greater depths. In this period the schools appar-

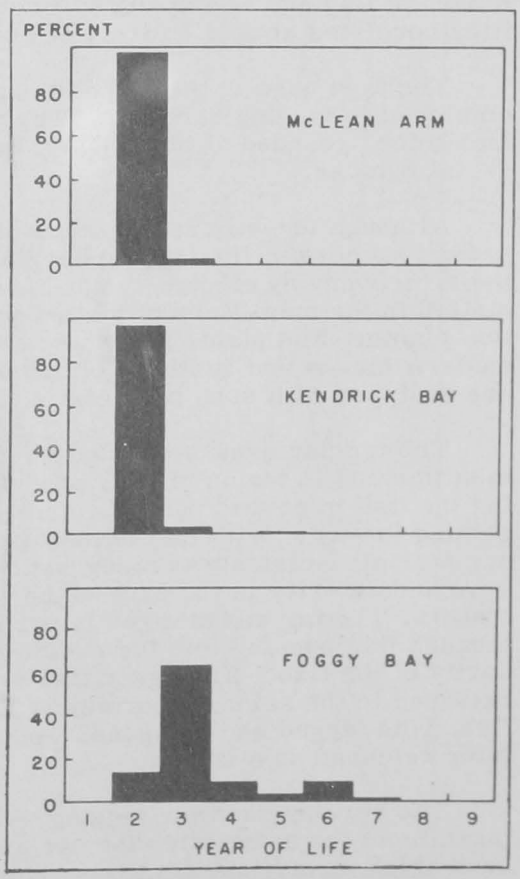

FIG. 8 - PERCENTAGE AGE COMPOSITION OF HERRING CATCHES, SOUTHEASTERN ALASKA, WINTER 1952/53.

ently congregate at certain localities where they remain until the approach of spawning in the spring. During the summer months the herring schools are constantly moving in search of food and do not appear in such dense concentrations as in the winter period.

These differences suggest that some modifications of fishing technique may be necessary for the development of successful winter operations. In this regard it is considered significant that the nets used by the Canadians are much deeper than those which have been used in Alaska. The Alaska seines, which are six to eight strips deep, fish effectively from 60 to 90 feet. The Canadian seines, which are twelve to fourteen strips, fish effectively at depths of 120 to 150 feet.

Table 5--Herring Tags Affixed in Southeastern Alaska, 1952

Date	Locality	Series	Number
12/8/52	South Arm Kendrick Bay	USF 3-A	492
"	"	" 4-A	299
12/9/52	"	" 7-A	999
"	"	" 8-A	200
	Total		1,990
12/15/52	Tongass Narrows	" 9-A	819
"	"	" 1-B	988
"	"	" 2-B	1,000
12/16/52	"	" 3-B	600
	Total		3,407
	Grand total		5,397

Finding herring in the winter is dependent almost entirely on the use of echo-sounding instruments. It is only rarely that the presence of herring can be detected by flips or feeding birds, as is frequently possible during the summer months.

TAGGING: A total of 5,397 herring were tagged, 1,990 in Kendrick Bay and 3,407 in Tongass Narrows (table 5). The international boundary line is approximately 15 miles south of Kendrick Bay and approximately 50 miles south of Tongass Narrows. In both localities the fish were caught by the John N. Cobb. A purse seine was used at Kendrick Bay and a lampara bait seine at Tongass Narrows. The catches in both localities consisted almost entirely of herring in their second year.

The tags used in this experiment were the internal metal belly tags customarily employed in tagging herring. These tags were 3/4-inch long, 5/32-inch wide, and 1/16-inch thick, rounded at both ends. Each tag bore the symbols USF, and an identifying serial number.

Although there is an appreciable tagging mortality, the internal metal tags have proven successful for tagging herring. The magnetic properties of these tags allow for their recovery by electro-magnets installed in the meal lines of the reduction plants. The plants in both southeastern Alaska and British Columbia are equipped with such magnets.

FIG. 9 - TAGGING HERRING, SOUTHEASTERN ALASKA, WINTER 1952/53.

The tagging crew consisted of four men working in teams of two, one holding the fish in position and the other inserting the tag. With the fish held belly up, a small incision was made just above and anterior to the base of the ventral fin. The tag was then gently pushed through this opening into the coelomic cavity of the fish. All tagged fish were returned to the seine, from which all fish, both tagged and untagged, were later released as a school.

The herring used for tagging were taken from the seine after the net had been dried up sufficiently to concentrate the fish. At this stage of hauling, the herring were confined in the fish bag, which rests between the vessel and the seine skiff. An outrigger pole was used to hold the seine skiff away from the side of the vessel, thereby

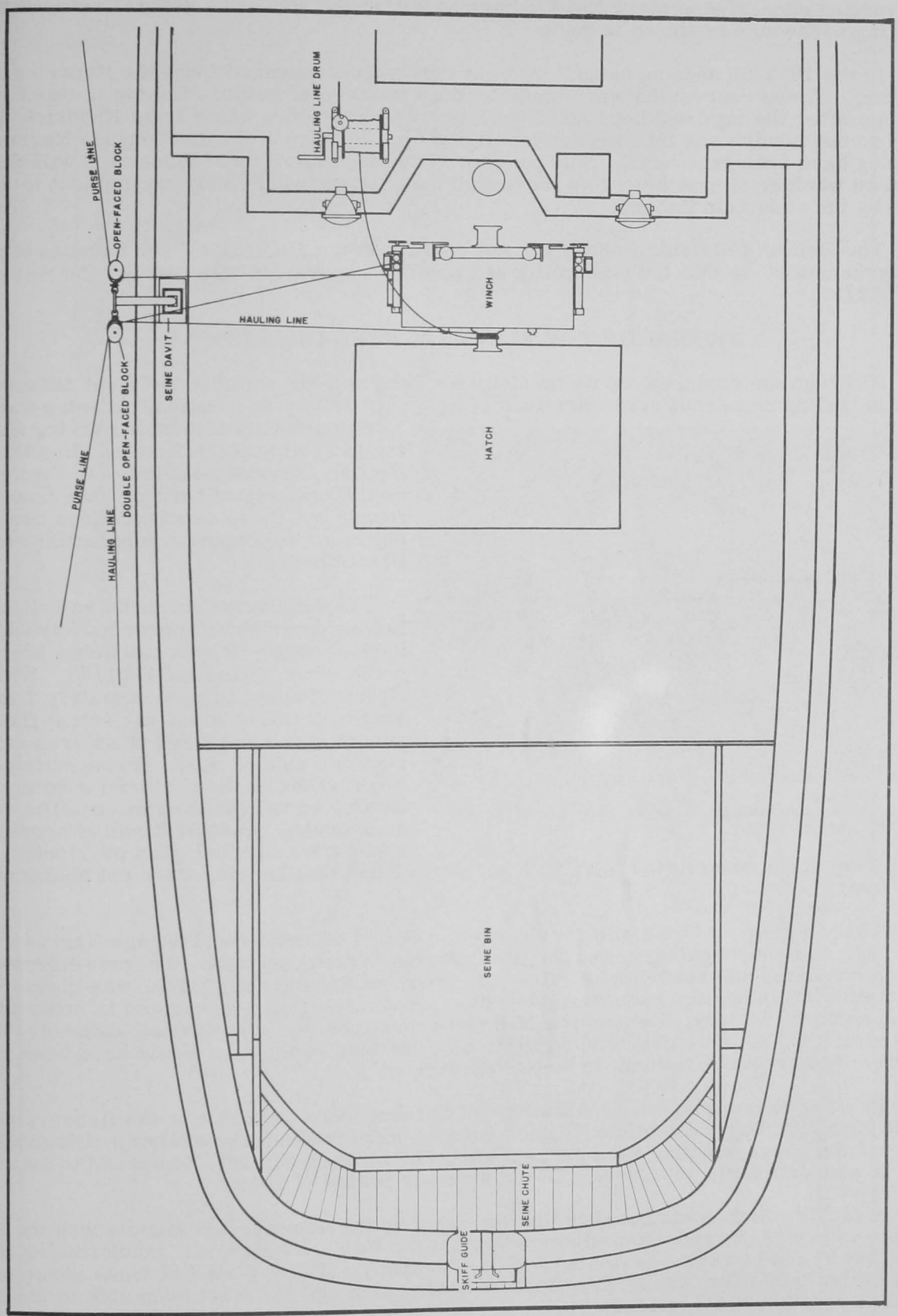

FIG. 10 - AFTERDECK OF THE JOHN N. COBB AS MODIFIED FOR PURSE-SEINING.

preventing excessive crowding of the herring within the net. The general setup of the tagging procedure is shown in figure 9.

In the 1952/53 season, a total of eight tags were recovered from the Kendrick Bay tagging. These recoveries were made by the commercial seiners fishing in this bay shortly after the tags had been affixed. Since all recoveries came from Kendrick Bay, they do not furnish any information on migration. No tags from the Tongass Narrows tagging have been recovered. The possibility for the recovery of these tags will depend on whether or not these fish move into other areas where they are subject to capture by the reduction fishery.

The British Columbia fishery did not operate in the 1952/53 season because of price disagreements, so that the possibility of Canadian recoveries was lost for the winter of 1952/53.

PROSPECTS FOR FUTURE WINTER OPERATIONS

Although the explorations by the John N. Cobb and the commercial fleet did not result in finding numerous concentrations of herring, this by no means eliminates the future possibility of winter herring fishing in Southeastern Alaska. In adjacent British Columbia waters only limited concentrations of herring have been found, but these concentrations are so dense as to support a substantial reduction fishery.

FIG. 11 - LAUNCHING SEINE SKIFF FROM THE STERN OF THE JOHN N. COBB.

Ogden Channel in northern British Columbia contributed approximately 480,000 barrels to the British Columbia herring catch in the season of 1951/52. While Ogden Channel is approximately 7 miles long by 2 miles wide, the actual fishing ground was comprised of an area of about one square mile. Prospecting in other areas of the northern subdistrict has failed to reveal other localities with comparable concentrations of herring. Had Ogden Channel been overlooked in exploring these waters, it might have been concluded that herring were not abundant in this area.

There appears to be a similarity between Ogden Channel and Tongass Narrows in that both are congregating areas for prespawning herring schools. Tongass Narrows, which contained an enormous quantity of herring throughout the winter, was closed by regulation to fishing for reduction purposes. Had these fish congregated in some locality open to the fishery, the success of these operations would have been assured. With this situation, the only practical limitation on the size of the take would have been the ability of the reduction plants to handle the fish.

In other areas where concentrations of herring were available to the fishery, such as in Kendrick Bay, exceptionally good catches were made. The analysis of logbooks showed the average catch was approximately 600 barrels per set, compared to an average of approximately 150 barrels in the summer period of 1952.

A factor which contributed to the low catch by the commercial vessels was the inability of one of the reduction plants to handle the fish. As a result, much fishing time was lost by the two vessels fishing for this company. The captains of these vessels declared that they could easily have doubled their catch had the plant been able to unload their fish with normal efficiency.

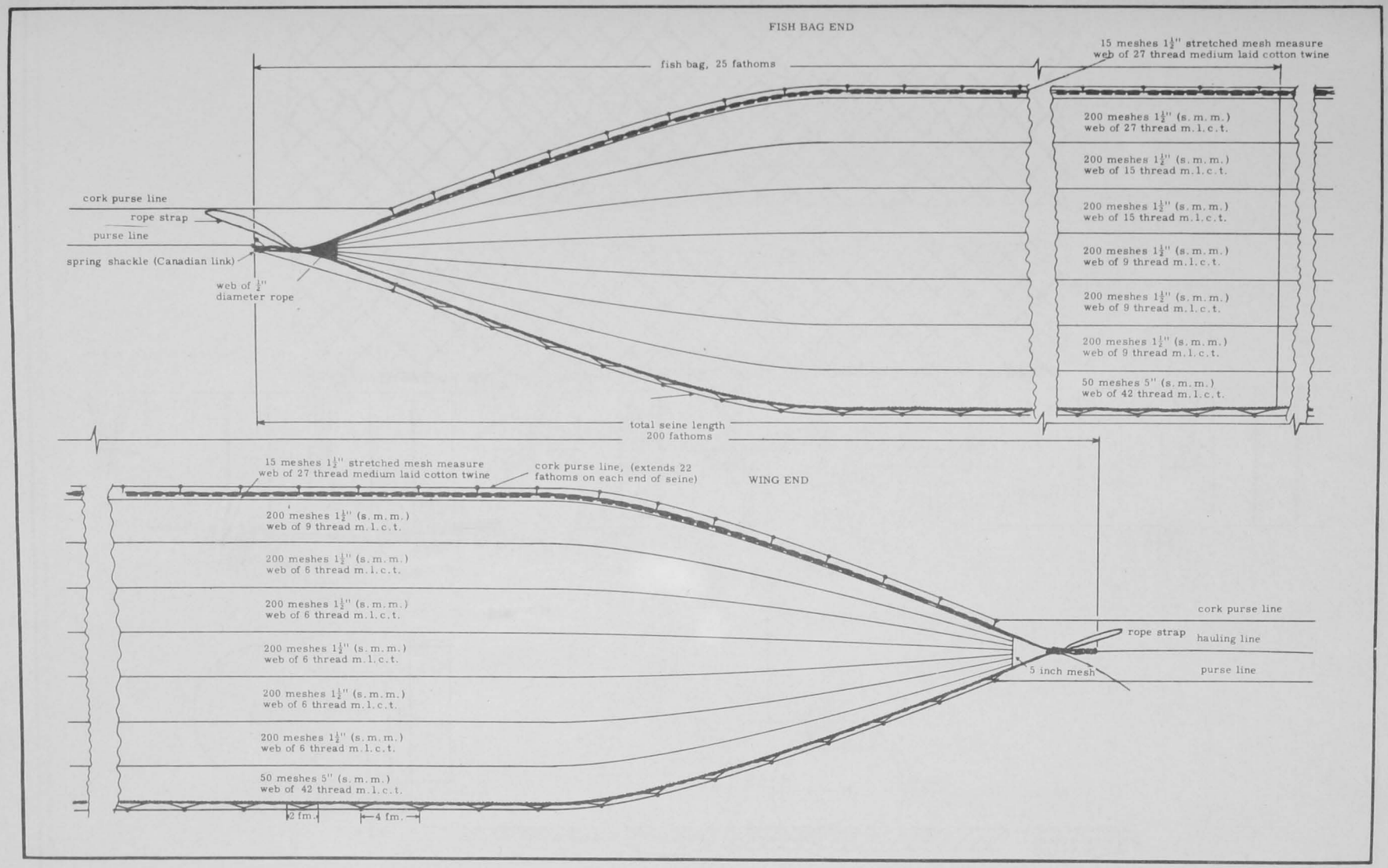

FIG. 12 - FISH BAG AND WING ENDS OF THE PURSE SEINE USED ON THE JOHN N. COBB IN HERRING EXPLORATION.

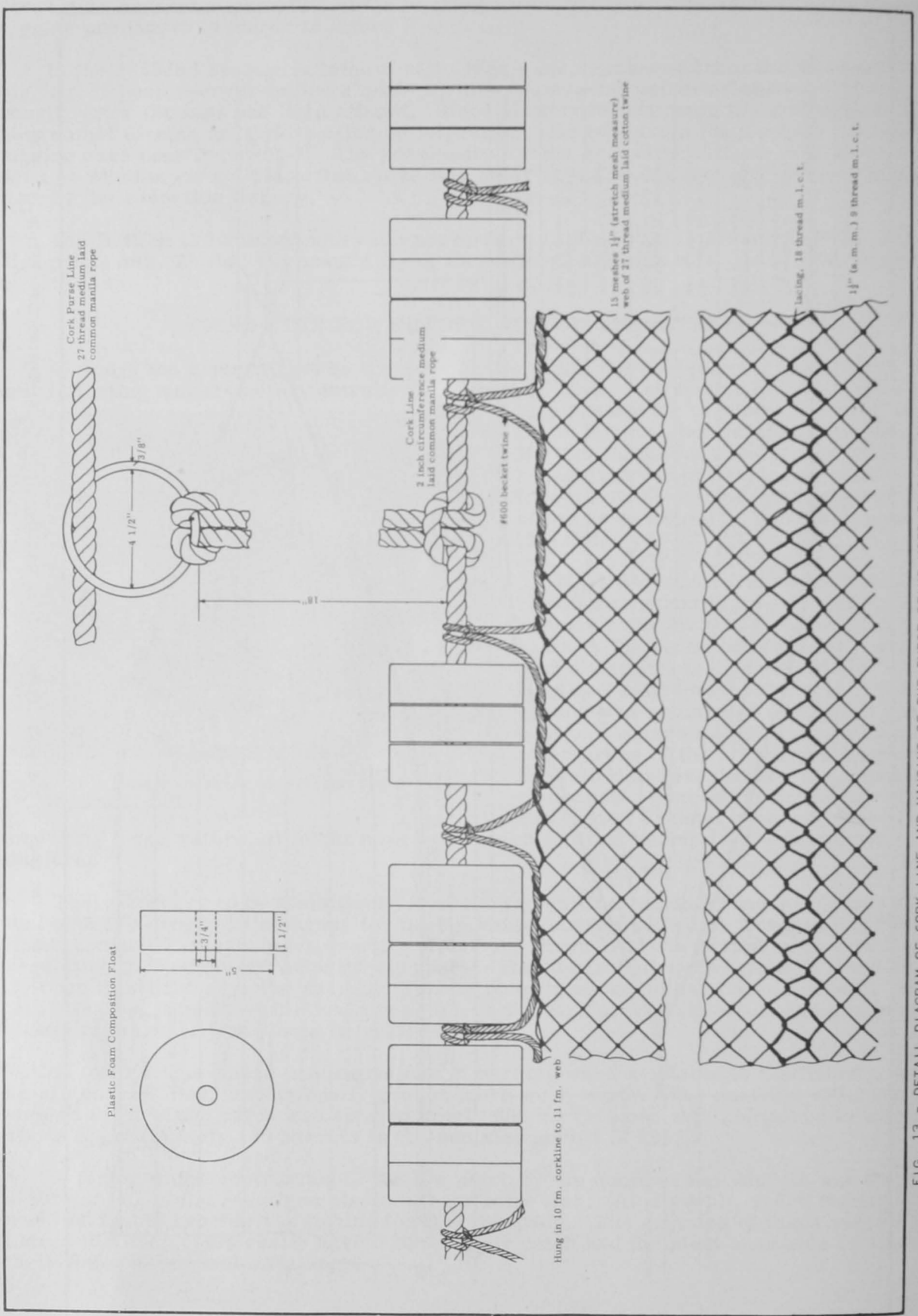

FIG. 13 - DETAIL DIAGRAM OF CORK LINE AND HANGING OF THE PURSE SEINE USED ON THE JOHN N. COBB IN HERRING EXPLORATION.

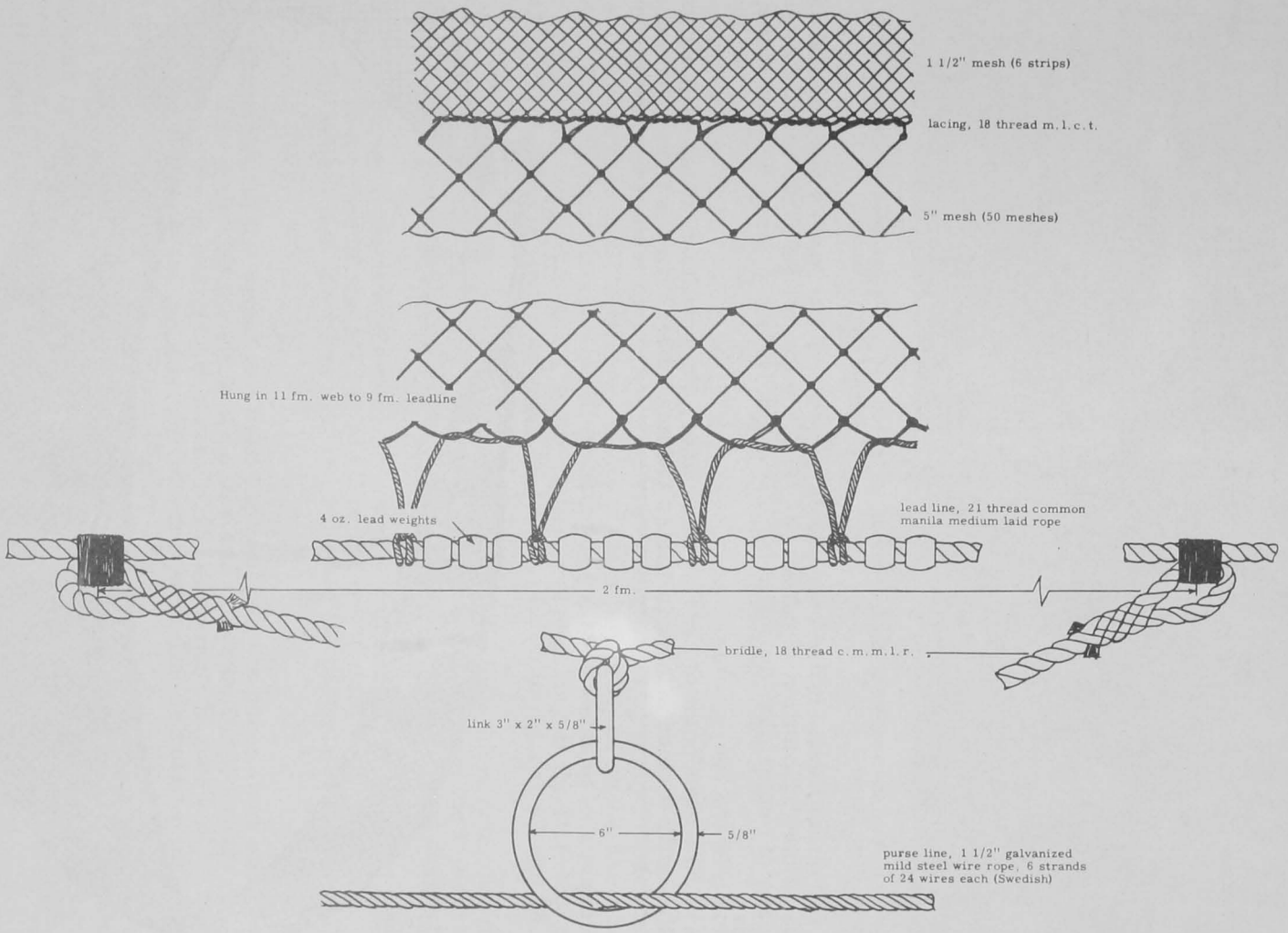

FIG. 14 - DETAIL DIAGRAM OF LEAD LINE AND HANGING OF THE PURSE SEINE USED ON THE JOHN N. COBB IN HERRING EXPLORATION.

In evaluating these results it should be remembered that the John N. Cobb was only one vessel attempting to cover a tremendous area, and that the commercial vessels were working at a different season of the year and in an area not previously exploited

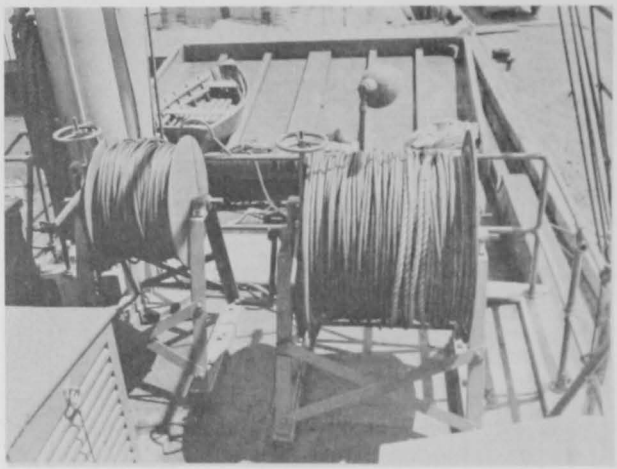

FIG. 15 - AFT HAULING- AND PURSE-LINE DRUMS OF ALASKA HERRING SEINER.

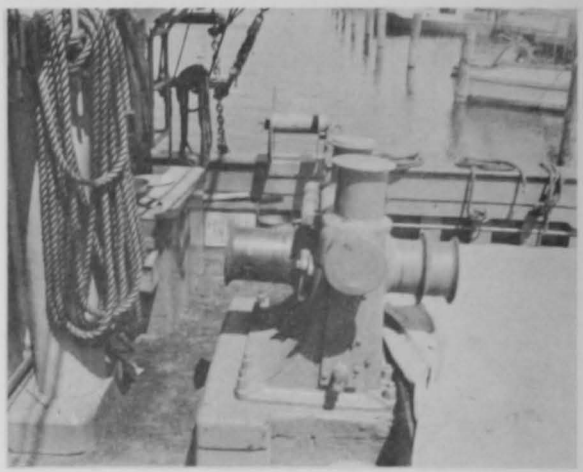

FIG. 16 - TYPICAL DECK WINCH ON ALASKA HERRING PURSE-SEINE VESSEL.

by the reduction fleet. It has been the experience of the Alaska herring fishery that success in the exploitation of new areas is seldom immediate but usually requires several years of exploration in which the fishermen learn the peculiarities of the fishing grounds.

From the standpoint of herring abundance, the results of these explorations would seem to justify further efforts in winter fishing, at least in the Dixon Entrance area.

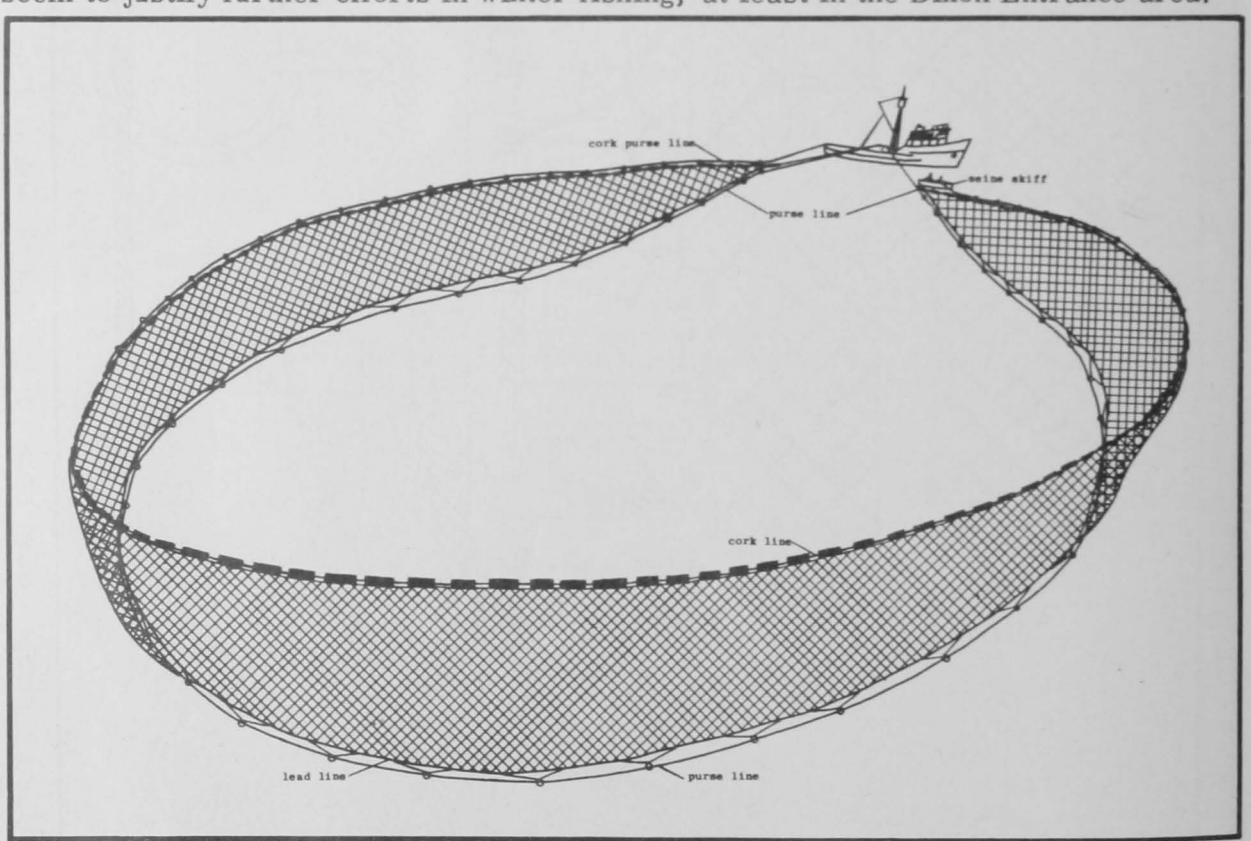

FIG. 17 - DIAGRAM OF ALASKA HERRING PURSE SEINE IN SET POSITION.

Whether or not such efforts will be made probably depends primarily on economic factors. The low oil yield of last winter, combined with the depressed state of the fish-oil market, probably resulted in financial losses for those companies concerned. It is doubtful that further commercial winter explorations can be anticipated until there is a substantial improvement in the market for fishery byproducts.

APPENDIX A - ALASKA HERRING-FISHING GEAR AND ITS OPERATION

MODIFICATIONS AND GEAR ON "JOHN N. COBB:" In order to adapt the John N. Cobb for work as a purse seiner, certain modifications were made to the afterdeck (figure 10). A net bin was constructed on the afterdeck and a seine chute was constructed across the stern to allow the seine to slide freely when making a set.

A skiff guide was built over the gunwale on the stern to facilitate launching the seine skiff.

On the starboard gunwale, a seine davit was installed opposite the winch, and a drum for the hauling line was mounted on the aft end of the deckhouse.

A standard tapered end-type Alaska herring purse seine of 200 fathoms length was used. Details of this seine are shown in figures 12, 13, and 14.

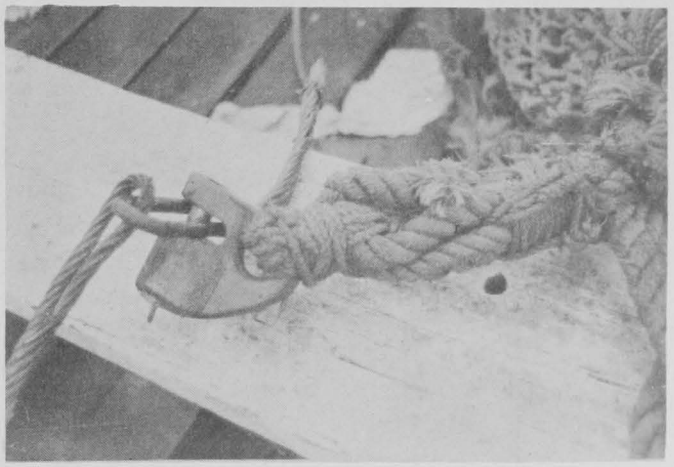

FIG. 18 - SPRING SHACKLE USED FOR ATTACHING BAG-END HAULING LINE AND PURSE LINE TO BAG END OF SEINE.

The use of rectangular-shaped nets with breast lines, described in other publications (Scofield 1951 and Murray 1952), has been discontinued by many of the Alaska herring seiners as they believe that any seine takes a tapered-end shape when being set and hauled. This taper is accomplished by gathering all the webbing to a piece of 5-inch web at the wing end and to a section of woven rope webbing at the fish-bag end. The webbing is hung to the cork line and lead line as shown in figures 13 and 14.

TYPICAL SEINING OPERATION: The foregoing describes the herring seining equipment used aboard the John N. Cobb. The gear arrangement on the typical herring seine vessel differs from that used on the John N. Cobb in the following respects:

1. The purse seine is stacked on a turntable rather than in a net bin. The turntable has a roller at the aft end to allow the net to roll freely over the stern of the vessel into the water. It is pivoted at its center and can be revolved.

2. Three drums (or reels) are used for taking in the purse lines and hauling lines. The drum for the aft hauling line and the drum for the purse line are mounted on the starboard aft corner of the deckhouse (figure 15). The drum for the forward hauling line and forward purse line is mounted on the port gunwale just opposite the winch (figure 16).

3. A winch with two gypsyheads is used for hauling the lines in. The aft gypsyhead is divided by a flange which provides two reeling surfaces. For convenience, the gypsyheads of the winch will be referred to as fore, middle, and aft (figure 16).

The operation of setting and retrieving the seine are given in the sequence of steps as follows:

1. The seine skiff is put over the stern and is towed close to the vessel by means of a painter (rope). The bag end of the seine is secured to the skiff by the

man, or sometimes two men, who operate the skiff. The skiff may or may not be powered.

2. When in suitable position in relation to the herring school, the painter is released from the deck of the vessel and a sea anchor is put out from the skiff. This slows the skiff and starts the seine off the turntable as the boat proceeds.

3. The vessel is steered in a circle around the school as the seine pays out from the turntable. The purse line comes off the outboard drum on the deckhouse, through the purse rings lined up in a trough on the port side of the turntable and into the water at the bottom of the seine.

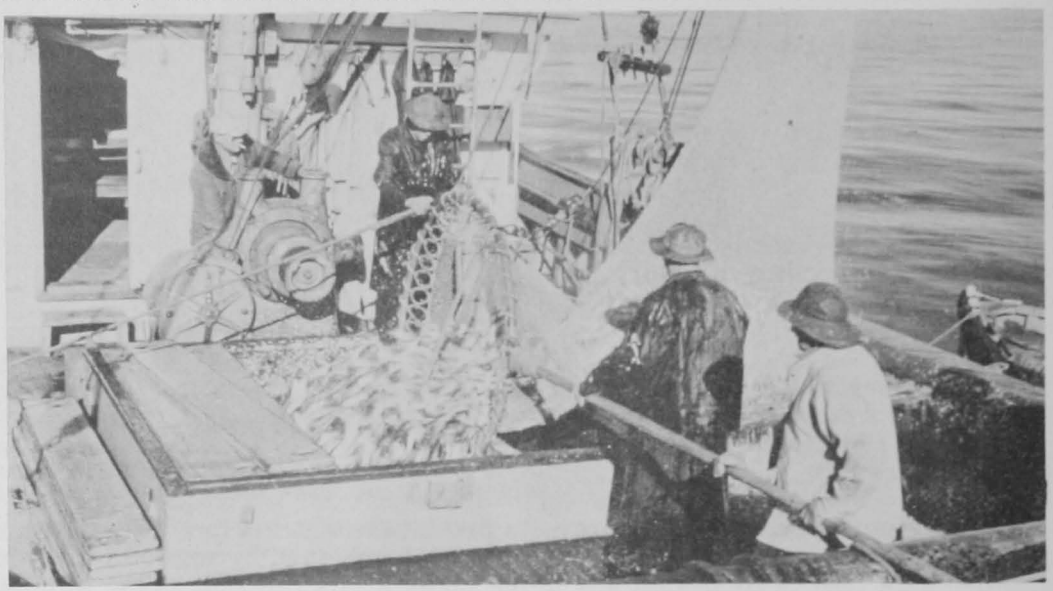

FIG. 19 - BRAILING HERRING FROM SEINE INTO HOLD OF VESSEL.

4. As the circle is nearly completed, the wing end of the seine goes off the turntable. This is attached by a shackle and swivel to the wing-end hauling line, which pays out from the inboard drum on the deckhouse.

5. A heaving line is thrown from the skiff to the vessel and the bag-end hauling line is pulled aboard.

6. At this point the following lines are hauled in simultaneously:

a. The forward hauling line, which is attached to the forward purse line and to the bag end of the seine by the spring shackle (figure 18) is taken in on the forward gypsyhead and wound on the drum at the port gunwale.

b. The aft purse line is taken in on the middle gypsyhead and wound on the outboard drum on the deckhouse.

c. The aft hauling line is taken in on the aft gypsyhead and wound on the inboard drum on the deckhouse.

d. The bag-end cork purse line is hauled by hand in the seine skiff and coiled there.

e. As soon as the aft hauling line is in, the wing-end cork purse line is hauled in on the aft gypsyhead and coiled on deck.

f. Pursing continues until all the purse rings are drawn up to the seine davit. A wire rope strap is then put through them and they are hoisted up and laid on deck.

7. The position of the turntable is then reversed so that the roller faces forward preparatory to taking the seine on board.

8. Starting with the wing end the seine is hauled aboard by means of a rope strap, which is wrapped around the body of the seine. It is hoisted by a single "whip" line which runs to the tip of the boom. In successive bights, the seine is hauled out of the water and lowered on to the turntable, where it is stacked in proper order for setting again.

9. "Strapping" is continued, crowding the fish into the fish-bag end of the net. When they are sufficiently concentrated, they are dipped out of the seine with the "brail" and spilled into the hold (figure 19).

10. When the fish have been removed, the remainder of the net is strapped aboard.

11. The turntable is turned about and the bag-end purse line is rewound from the port gunwale drum to the outboard drum on the deckhouse.

12. The purse line is threaded through the purse rings and attached by the spring shackle to the bag end of the seine preparatory to making a new net.

APPENDIX B - JOHN N. COBB FISHING LOG FOR CRUISE 14
(November 4 to December 19, 1952)

November 4-7: Cleared King County Dock at Seattle, Washington, and proceeded on routine trip to Ketchikan, Alaska. Entered Tongass Narrows at 0830 and observed large flocks of sea gulls apparently feeding on herring. Fish were noted on the echo sounder between 40 and 80 feet.

November 8: Arrived at Washington Bay. Spent day unloading salt, and loading purse seine and rigging gear.

November 9: Made a practice set of the purse seine in Washington Bay. Sounded Bay of Pillars, Tebenkof Bay, and Port Conclusion with the echo sounder. The only indication of herring was one small "pip" recorded on the echo sounder in Pillar Bay and a few scattered birds in Tebenkof Bay.

November 10: Sounded Port Armstrong and Port Walter and made run toward Cape Ommaney area. The sea was too rough for making herring observations in the Cape Ommaney-Larch Bay area so the region was bypassed.

One whale was seen at the mouth of Port Walter, but no indication of herring was obtained in the Port Conclusion-Port Walter or the Cape Ommaney area. No indication of herring was seen in the Murder Cove area although a few small birds were observed.

November 11: 0700-1200 lay at Tyee due to strong southeast wind and rain. 1300-1730 scouted and sounded Security Bay, Saginaw Bay, Keku Strait, and Kake area. Several gulls were seen in Security Bay and cormorants were observed on the north side of Saginaw Bay. One small pip recorded on the echo sounder while passing the northwest tip of Keku Island. The Service's vessel Crane reported that herring flippers were seen in Big John Bay on the evening of this date.

November 12: Sounded Kake and upper Keku Strait area. Sounded Port Camden to about two-thirds the way to the head of the bay. No evidence of herring was found in the Keku Strait-Kake area but large schools were recorded by the echo sounder near the mouth of and inside Port Camden. These large schools appeared over depressions or "gullies" in the bottom. The largest of these schools was lying over a sharp depression at depths of from 180 feet to near the bottom of the depression at 260 feet. This school was approximately 3 miles inward from the mouth of the bay. Numerous small pips were recorded from near the surface to the bottom in the outer one-half of the bay. Small herring were brought to the surface near midnight on November 12 by playing the searchlight and a submarine light on the water. Several herring taken in dip nets proved to be one- and two-year-old fish.

November 13: Continued sounding in Port Camden and Keku Strait areas. Herring in Port Camden appeared deeper and even more densely packed over depressions in the bottom than on November 12. Left area at 1225 for Seymour Canal. Echo sounder recorded several small pips of feed between Port McCartney and Turnabout Island. Entered Seymour Canal at 1525; evidence of small amounts of feed showed on echo sounder at 60- to 80-foot depths, numerous sea gulls, several whales, and one hair seal were seen near the entrance to Mole Harbor in Seymour Canal. Anchored for night in Mole Harbor. Night observations revealed no herring.

November 14: Sounded Seymour Canal from Mole Harbor to Windfall Harbor including area around Dorn Island and Tiedeman Island. A scattering of small traces were recorded in Mole Harbor from the surface to 80 feet. A murre was seen with a fish of about 2 inches in length, and one small fish (presumably herring) was seen flipping. Scattered birds were seen working the entire bay. In the vicinity of Tiedeman Island and Windfall Harbor, many small birds and numerous whales were seen but no evidence of herring, other than small pips at various depths on the echo-sounder tape. Launched seine skiff and prepared for possible night set at 1500. At 1735, in the mouth of Pleasant Bay, a large dark trace appeared on the sounder tape at 40- to 80-foot depths. This area was drifted, sounding until 1945. The sounder showed numerous small pips which seemed to be fish rising toward the surface. Another fairly good-sized school was recorded at 1815 in the stratum 20 to 76 feet.

November 15: Left Seymour Canal. Sounded area on west side of The Brothers Islands, the

right arm of Pybus Bay, and the right arm of Gambier Bay. A few small pips were recorded near The Brothers Islands and in the right arm of Gambier Bay. Otherwise no sign of herring was seen in this area.

November 16: Left Gambier Bay for Petersburg. Small pips of feed were encountered in the vicinity of Sukoi Island. Fair to good showings of feed were recorded at the north entrance to Wrangell Narrows. Arrived at Petersburg at 1625.

November 17: Left Petersburg at 0900 for Windham Bay. A light and narrow band was recorded on the echo sounder at 180 feet just inside of Sunset Island near Windham Bay. Soundings in Windham Bay showed no evidence of herring. Upon rechecking the Sunset Island area the light narrow tracing was again picked up. This tracing continued for 10 miles as the vessel proceeded up Stephens Passage, rising gradually as darkness fell until it ended at 1630 off Point Astley. A herring jig was tried at the depth of this recording with no results. Anchored at 2005 in southeastern end of Gilbert Bay.

November 18: Sounded in Gilbert Bay and Port Snettisham and then proceeded to Juneau. Some very small pips were recorded at about 30 feet near Whiting River in Gilbert Bay. No other indications were seen in upper Stephens Passage or Port Snettisham. Arrived at Juneau at 1248.

November 19: Left Juneau at 0900. Sounded Gastineau Channel and westward in Stephens Passage to Barlow Cove. A scattering of small pips was recorded off the SE. tip of Douglas Island (Point Hilda) from 20 feet to the bottom at 240 feet. Several gulls were observed upon entering Barlow Cove at 1345. The cove was sounded until 1730, but only a few scattered small pips were recorded.

November 20: Raised anchor in Barlow Cove and sounded out of cove heading for Lisianski Inlet. At 1145 observed five small pips at 20 fathoms between Porpoise Islands and Hoonah in Icy Strait. Sounded between Eagle Point and Point Adolphus, recording only a few small pips from the surface to the 120-foot depth. Ran SE. in Lisianski Inlet to Pelican City. A group of sea gulls and a sea lion were observed at the junction of Lisianski Strait and Inlet but no tracings were recorded on the echo sounder. A large flock of sea gulls sitting on the water near Pelican City was investigated but no pips were recorded on the sounder.

November 21: Left Pelican City, sounding toward the head of the inlet. Found one school of herring at $1\frac{1}{2}$ miles north of Soloma Point. Made preparation for a set. Sounded to the head of the inlet with negative results. Herring were found again in the vicinity of Soloma Point in two schools estimated by Fishing Captain Hansen to be about 200 barrels each. Two herring were caught on the jig gear. These schools were too close to the beach to make a purse-seine set on them. Near Miner Island several large brown spots indicating schools of fish were observed. Large flocks of gulls were seen working here and several were seen catching fish. Upon sounding over these schools, large light tracings were recorded from the surface to the 80-foot depth. This area was fished with the herring jig and approximately 10 young rockfish about 3 to 4 inches in length were caught. These fish were staying close to the creek mouth.

November 22: Sounded from Lisianski Inlet to Idaho Inlet finding no evidence of herring on the echo sounder. At 1245 a large group of gulls was investigated in Idaho Inlet. A fairly large group of small pips was recorded at 20 feet to 40 feet, but the jig gear failed to catch any herring. Continued sounding and investigating bird groups in Idaho Inlet until 1554. No evidence of commercial quantities of herring was found here.

November 23: Left Hoonah at 0930 and sounded Port Frederick, finding a few scattered pips of feed distributed from the surface to the 400-foot depth, but otherwise no sign of herring. Left Port Frederick for Freshwater Bay at 1300. Entered Freshwater Bay at 1710 and sounded in the vicinity of Wachusett Cove and Pavlof Harbor finding no indications of birds or herring.

November 24: 0800. Started sounding out of Freshwater Bay to Tenakee Inlet; no sign of herring. Sounded in area off the Superior Packing Co. cannery, finding no indication of feed and no birds. At 1030 the Bendix echo sounder stopped operating due to a burned out motor; Juneau was contacted by radio for parts and sounding was continued with the Submarine Signal Co. flasher-type echo sounder. Tenakee Inlet was investigated to a point approximately 7 miles from the head of the inlet. At 1635 a small flock of gulls and murres was seen working in the tide rip 3 miles west of Long Bay area, Tenakee Inlet. Anchored near Long Bay at 1930. The searchlight was played upon the water at night but failed to raise any herring.

November 25: Continued observations in Tenakee Inlet until 1135 with negative results and then left for Hawk Inlet. Investigated Hawk Inlet from 1335 to 1535 finding several hair seals, and large flocks of scoters, ducks, and gulls in the vicinity of the river flats, but no other indications of herring either on the surface or on the echo sounder. Proceeded toward Juneau to repair echo sounder. Anchored in Barlow Cove at 1850.

November 26: Sounded from Barlow Cove to Juneau, finding no indications of herring schools. Several whales were noticed in the vicinity of Point Tantallon.

November 27, 28, and 29: Waited for parts to repair echo sounder at Juneau.

November 30: While running, sounded Peril Strait, Salisbury Sound, and Neva Strait, anchoring in Nakwasina Passage at 1640.

December 1: Sounded Katlian Bay. Two small tracings were recorded at a depth of 220 feet and small fish were seen surfacing among the rocks and small islands in the north end of the bay. Sounded past Sitka to Silver Bay entering the bay at 1150. Many sea lions and a whale were observed at the mouth of the bay. Large schools of herring were recorded lying on the bottom at the 220-foot depth at the entrance to the bay.

Tied up at Sitka at 1328 and returned to Silver Bay at 1700. A large body of fish was picked up again at the entrance to the bay. This school was about two-thirds of a mile long by one-third of a mile wide, lying deep, mostly just off the bottom at the 250-foot depth. At about 1900, good-size herring were heard flipping all about the boat, but

the echo sounder showed the main body of fish to be lying near the bottom. Fishing Captain Hansen said he had never heard so many flippers nor seen such a compact concentration of herring in any area. A purse-seine set was made at 1955, but the school was missed and only a few small herring were caught. The school was either too deep or sounded as the set was made. Net back aboard at 2145.

December 2: Left Sitka, running southeasterly down outside coast of Baranof Island. Sounded Larch Bay from 1600 to 1625 finding no indications of herring on the echo sounder. The sea was too rough to work the area well. Anchored in Port Armstrong at 1800.

December 3: Remained in Port Armstrong due to storm warnings and winds to gale force in Chatham Strait.

December 4: Left Port Armstrong for the Warren Island area. Sounded the Warren Channel, Bocas de Finas, Gulf of Esquibel, and Arriage Passage area including Steamboat Bay and the east side of St. Joseph Island. These areas were devoid of signs of herring except for a few scattered birds and three whales seen in the vicinity of Noyes Island.

December 5: Investigated Davidson Inlet and Tokeen Bay with negative results. Only a very few scattered gulls were seen. Cleared Davidson for Ketchikan with sounder operating.

December 6: Proceeded to Wards Cove in Tongass Narrows to observe herring reduction there. Sounded Narrows en route to and from Wards Cove, finding no schools of herring. Sounded Tongass Narrows near Ketchikan from 1610 to 1850. Large schools were recorded, apparently beginning to rise from the bottom at about 1700. At 1742 to 1752 a nearly solid school of herring was found extending from the Coast Guard Base to the Northern Machine Works, a distance of $1\frac{1}{2}$ miles on the Ketchikan waterfront. This school extended from the 20- to about the 80-foot depth.

December 7: Left Ketchikan for Kendrick Bay. Sounded south arm and short arm of Kendrick Bay and McLean Arm. Many birds, sea lions, and a few hair seals were seen in Kendrick Bay, and schools of fish were recorded near the bottom in both Kendrick Bay and McLean Arm. At 2100 the sounder showed a school of fish at the 20- to 40-foot depth in McLean Arm. These were apparently rising. Some of these fish were drawn up to light and were seen to be small.

December 8: Sounded again in McLean Arm and Kendrick Bay. Fish were recorded by the sounder in both places near the bottom. Anchored in Kendrick Bay at 1030 to await darkness and the rising of the herring. Started sounding again at 1700 and set on large school 20 to 80 feet deep. Pursed seine, catching approximately 1500 barrels of small herring.

December 9: Spent day tagging herring and overhauling gear.

December 10: Left Kendrick Bay for Carroll Inlet. Sounded Carroll Inlet to head, finding only a few small pips on meter at the entrance and several sea gulls and murres near Gnat Cove. Anchored near Spit Cove at 1512. Raised anchor at 1845 and sounded toward mouth of the inlet.

December 11: Sounded out of Carroll Inlet and found no more indication of herring. Sounded George Inlet to vicinity of Libby's cannery. In this area several small pips near the surface and large dark tracings of schools of herring on the bottom at 200 feet were recorded. Left area for Ketchikan at 1000. Tied up at Ketchikan for mail and motorboat repairs. Left for Washington Bay at 1610.

December 12: Arrived at Washington Bay and spent day repairing and salting down purse seine.

December 13: Finished repairing and storing net.

December 14: Left Washington Bay for Ketchikan.

December 15: 0455. Arrived at Ketchikan and tied up at Tongass Trading dock. The echo sounder and flippers indicated herring just off the dock. A set was made on these with the lampara net and seine skiff to catch herring for tagging. Spent the day tagging herring.

December 16: Tagged herring from 0830 to 1100 and then left for Metlakahtla to consult with personnel of Oceanic Fisheries Co. on their reduction barge there.

December 16-19: Routine run to Seattle, arriving at Fish and Wildlife Service's dock at 1500, December 19.

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SMALL FRY ARE IMPORTANT

Today's children are tomorrow's customers. If they are trained to like fish and shellfish when they are young, it is likely that they will acquire a fondness for products-of-the-sea that will carry on when they later become heads of families. This fact was well confirmed in tests of the eating habits of men in the Armed Forces during World War II.

SCHOOLS ARE A MARKET FOR FISH.

Until a few years ago there was a widespread feeling that children did not like fish and would not eat it at school. Actual tests in schools however, have proven that if fish (or shellfish) is prepared properly and served attractively, school children will not only eat it but will acquire a liking for it.

Fish-cookery demonstrations by home economists of the Educational and Market Development Section of the U. S. Fish and Wildlife Service for school lunchroom supervisors, managers, and cooks constitute a substantial part of the educational program to get the children to eat and like fishery products. In every one of the 26 states where this program has been given so far, fishery products are now served more often and enjoyed by more children. As a result of this the schools are buying more fish.

The fish-cookery demonstration program of the Service is conducted in cooperation with the different state departments of education. To date, 21 of the 26 states east of the Mississippi River have had statewide programs for their school lunchroom personnel. Louisiana and Minnesota have also been covered. In several of the Plains States and in the three Pacific Coast States, the Service has presented several demonstrations but not on an extensive basis. This school year the program is being conducted in Iowa, Wisconsin, Michigan, Oklahoma, Pennsylvania, and West Virginia.