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JAPANESE HIGH-SEAS MOTHERSHIP-TYPE DRIFT GILL-NET SALMON FISHERY--1954

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CONTENTS

BACKGROUND

Japanese salmon fishery interests in 1954 resumed their third year of operation in the North Pacific Ocean since the signing of the Tripartite Fishery Treaty (May

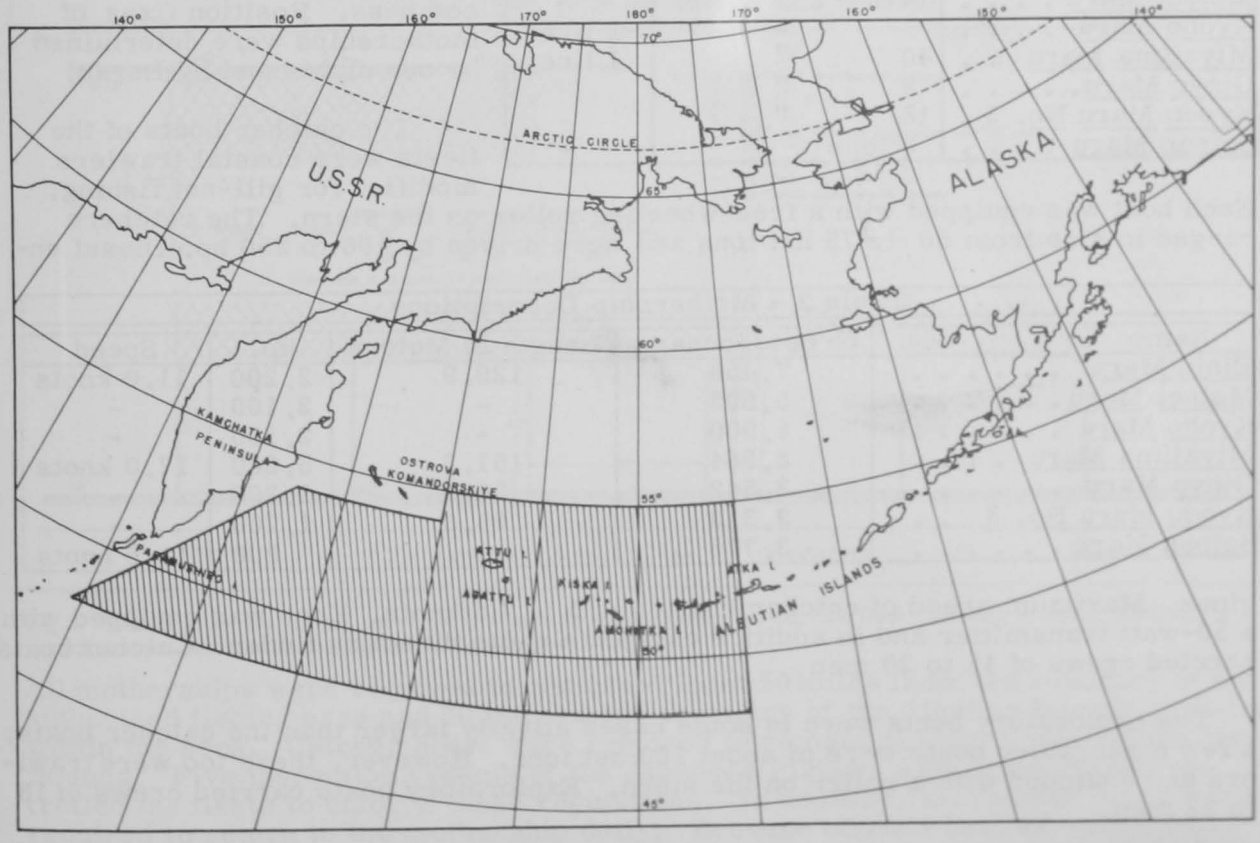

Fig. 1 - Chart of the Bering Sea and North Pacific Ocean. Shaded portion shows fishing area authorized by the Japanese Fishery Agency for the 1954 salmon-fishing fleets.

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1952). Prior to departure of the 1952 expedition the Japanese Fishery Agency extended an invitation to the U. S. Fish and Wildlife Service to place a biologist aboard one of the motherships to accompany the fleet during its fishing operations in the offshore waters of the Aleutian Islands and Kamchatka. The activities of that expedition were described by Fukuhara (1953). A similar invitation was extended by the Japanese Fishery Agency to the Service in 1954. In response to this invitation the author was assigned to accompany the Japanese fleet during the 1954 high-seas salmon-fishing season.

The following is a narrative account of the activities of the 1954 salmon fleet.

Transportation to the Japanese fleet was provided by the U.S. C.G.C. Clover. Between June 20 and July 9 the writer was aboard the S. S. Einin Maru, mothership of the Taiyo Fishing Co., Ltd., and from July 10 to August 23 aboard the M.S. Miyajima Maru, mothership of the Nippon Suisan Co., Ltd. The ships' logs, catch data, and the fishing logs of these two fleets were made accessible to the author. These courtesies, extended by Mr. S. Mori and Mr. T. Ito, fleet managers of the Taiyo and Nippon Suisan fleets, respectively, are gratefully acknowledged.

THE FISHING FLEETS

Seven fleets participated in the 1954 high-seas salmon fishery. Descriptions and facilities of all motherships and accompanying catcher boats appear in a Japanese fishery periodical (Anonymous 1954).

Table 1 - Facilities of Motherships

Name	Facilities for:	
	Refrigeration	Canning
Einin Maru	23 compartments	2 lines
Meisei Maru	14 "	-
Kyoho Maru	-	2 lines
Miyajima Maru . .	40 "	1 line
Ginyo Maru.	9 "	-
Kyodo Maru No. 3 .	15 "	-
Saipan Maru	3 tons	-

All motherships were equipped with radio direction finder, Loran, radar, and gyrocompass. Position fixes of motherships were determined by sun sights and by Loran.

The catcher boats of the fleets were coastal trawlers modified for gill-net fishing. Each boat was equipped with a free-wheeling roller on the stern. The catchers ranged in size from 50 to 75 net tons and were driven by 160 to 250 hp. Diesel engines. Maximum speed of catcher boats was 5 to 7.5 knots. Each was equipped with a 50-watt transmitter and in addition carried a radio direction finder. Catcher boats carried crews of 15 to 20 men.

Table 2 - Mothership Descriptions

Name	Gross Tonnage	Length in Meters	hp.	Speed
Einin Maru	7,456	129.9	2,200	11.0 knots
Meisei Maru.	5,603	-	2,100	-
Kyoho Maru	6,900	-	2,100	-
Miyajima Maru	8,964	151.3	5,500	17.0 knots
Ginyo Maru	3,542	96.2	1,800	-
Kyodo Maru No. 3 . .	2,313	85.8	1,700	-
Saipan Maru	3,778	-	900	11.5 knots

The exploratory boats were in some cases slightly larger than the catcher boats; a few exploratory boats were of about 100 net tons. However, these too were trawlers and equipped with a roller on the stern. Exploratory boats carried crews of 18 to 22 men.

The positions of catcher boats were calculated relative to the position of the mothership. Their bearings were established by the radio direction finder from the mothership. The distance of a catcher boat from the mothership was computed from the cruising speed of the catcher boat and the number of hours run from the mothership (cruising speed times hours under way). Due to their greater range of operation, the exploratory boats used sun sights to establish positions.

Table 3 - Number of Catcher Boats by Fleet

Name	No. of Catchers	No. of Scout Boats	Total
Einin Maru	32	6	38
Meisei Maru . . .	28	6	34
Kyoho Maru	19	4	23
Miyajima Maru . .	33	6	39
Ginyo Maru	20	4	24
Kyodo Maru No. 3.	14	4	18
Saipan Maru	14	4	18
Total	160	34	194

FISHING SEASON

Exploratory boats of all fleets were fishing on the grounds early in May, in advance of the main fleets; however the first motherships to arrive on the fishing grounds commenced fishing operations on May 15, with later fleets commencing operations on May 20.

FISHING AREA AND REGULATIONS PERTINENT TO FISHING

The 1954 mothership-type salmon-fishing operation was limited to an area within a line joining the following points: 55°00'N., 175°00'W.; 55°00'N., 170°00'E.; 54°00'N., 170°00'E.; 54°00'N.; 162°30'E.; 48°00'N., 154°30'E.; 48°00'N., 175°00'W. (fig. 1).

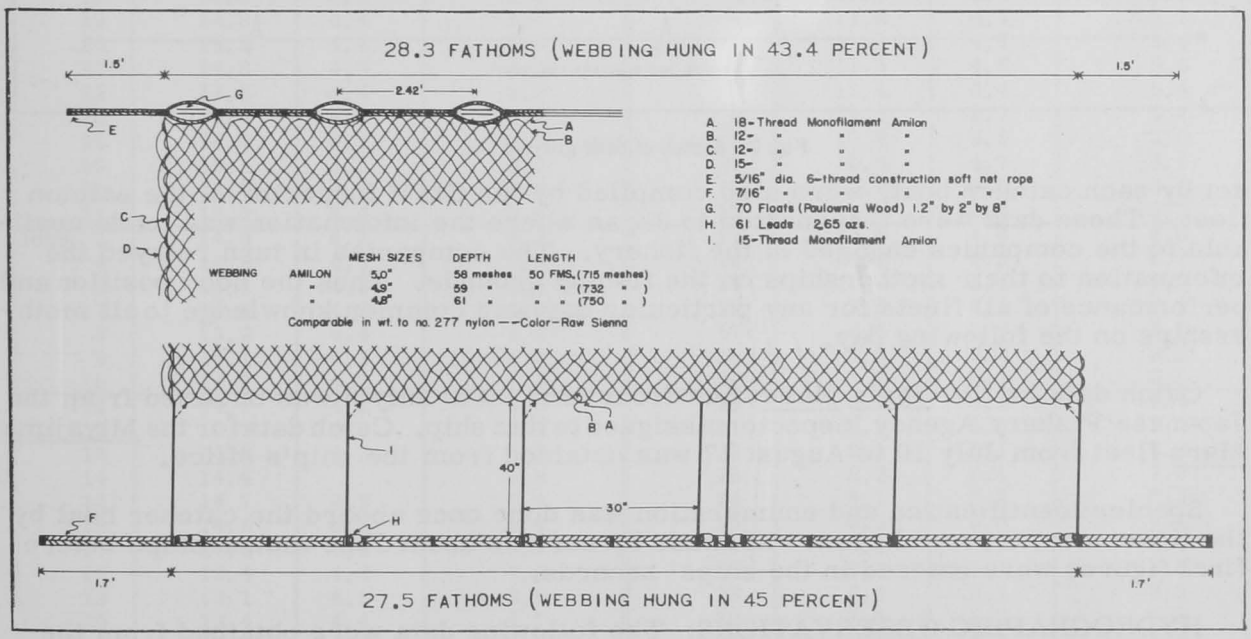

Fig. 2 - Details of a "tan" of gill net of the type used by the Nippon Suisan Co. Ltd. fleet. Webbing in net is "Amilon," a synthetic product similar to nylon but with less stretch factor.

All motherships were required to remain at least 50 miles from the boundary of the authorized fishing area and 50 miles away from any of the Aleutian Islands included within the area. Catcher boats were required to remain at least 3 miles from the islands. Five inspection vessels of the Japanese Fishery Agency constantly patrolled the fleets to enforce these regulations. In addition, all catcher boats were required to return to the mothership daily. Because of their limited speed, catcher boats were limited to within a 50-mile radius of the motherships. A Fishery

Agency inspector was assigned to each mothership and among his other duties he checked in all catchers daily. The Fishery Agency inspectors aboard the motherships also received carbon copies of the daily catch by species and by catcher boat, and catcher-boat positions. These data were coded and transmitted to the Chief Inspection vessel every evening.

Fishing operations commenced in the eastern portion of the authorized fishing area and with the advance in season the movement of the fleets was westward. By mid-July all fleets were westward of 160° E. longitude (about 300 miles south of Bering Island in the Kommandorskii group).

SOURCES OF DATA

CATCH DATA: The daily catch by species for the entire fishing season from all the fleets was obtained from the Taiyo Fishing Co., Ltd. As previously stated, daily catch statistics from all motherships were requested by the Japanese Fishery Agency. Related data, such as noon position and numbers of "tan" (units of gill net)

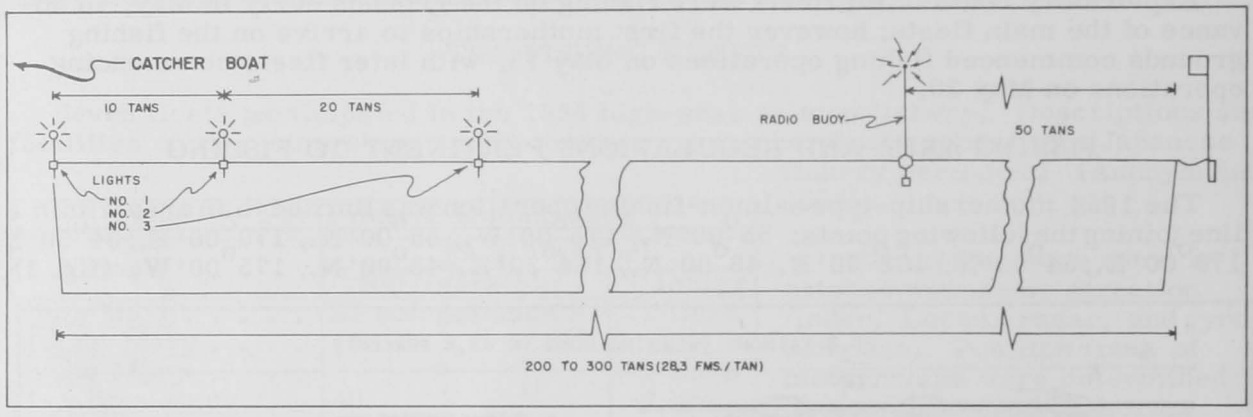

Fig. 3 - Sketch of drift gill-net set.

set by each catcher boat, were also compiled by the Chief Inspector of the salmon fleet. These data were transmitted to Japan where the information was made available to the companies engaged in the fishery. The companies in turn relayed the information to their motherships on the fishing grounds. Thus the noon position and performance of all fleets for any particular day was common knowledge to all motherships on the following day.

Catch data for the Einin Maru fleet from June 20 to July 6 was obtained from the Japanese Fishery Agency Inspector assigned to that ship. Catch data for the Miyajima Maru fleet from July 10 to August 17 was obtained from the ship's office.

Species identification and enumeration was done once aboard the catcher boat by the fishermen; a second count was made by sorters aboard the motherships before final figures were entered in the ships' records.

HYDROGRAPHIC OBSERVATIONS: The following data were obtained from the fishing logs of the Einin Maru and Miyajima Maru:

1. Einin Maru (June 20 to July 6)

   (a) Daily catcher boat positions.

   (b) Surface water temperatures taken daily by all catcher boats at position of set.

2. Miyajima Maru (May 16 to August 17)

(a) Daily catcher boat positions.

(b) Surface water temperatures taken daily by all catcher boats at position of set.

(c) Water color (Forel Scale) taken daily by catchers.

(d) Secchi disk visibility taken daily by catchers.

(e) Subsurface temperatures to 60 meters taken by exploratory boats only.

Surface water temperatures were taken by all catcher boats generally while under way. All thermometers used by catchers of the Nippon Suisan fleet were calibrated for error by a meteorological agency in Japan. Errors in the instruments for the temperature ranges encountered in the North Pacific during the fishing season were less than 0.1° C. A printed manual was issued with each thermometer to standardize methods of taking temperatures and reading the thermometer.

Table 4 - Average Water Transparency, Water Color, and Surface Water Temperature Recorded by the Miyajima Maru Fleet, May 14 to August 5

Date	Water Transp. 1/	Water Color 2/	Surface Water Temp. °C.	Date	Water Transp. 1/	Water Color 2/	Surface Water Temp. °C.
May 14	13.1	4.3	3.6	June 29	11.9	4.4	5.5
15	13.0	4.1	3.7	30	12.2	4.6	5.4
16	12.8	3.9	3.6	July 1	11.2	4.8	5.2
17	14.6	4.0	3.6	2	12.0	4.7	5.3
18	15.0	4.2	3.9	3	11.2	4.8	5.1
19	14.9	4.4	3.7	4	11.5	4.7	5.3
20	14.9	4.4	3.8	5	11.9	4.7	5.4
21	14.8	4.3	3.8	6	11.5	4.6	5.6
22	14.5	4.4	3.8	7	11.4	4.4	5.4
23	14.4	4.2	3.7	8	11.2	4.7	5.7
25	14.6	4.4	3.6	9	10.8	4.5	5.9
29	15.1	4.3	3.3	10	10.5	4.7	5.9
30	14.9	4.2	3.3	11	11.2	4.5	6.4
31	15.2	4.4	3.4	12	10.4	4.7	6.1
June 1	14.8	4.2	3.3	13	10.6	4.8	6.0
4	14.8	4.3	3.3	14	11.1	4.5	6.2
5	15.1	4.3	3.4	15	11.4	5.4	6.9
7	15.0	4.3	3.6	16	9.8	5.4	7.3
8	15.2	4.4	3.4	17	8.8	5.7	7.8
9	15.1	4.3	4.0	18	7.6	6.2	8.0
10	14.9	4.2	4.0	19	7.3	6.1	8.8
11	14.7	4.2	3.6	20	6.7	6.1	8.4
12	14.7	4.3	3.5	21	9.3	5.2	7.8
13	14.3	4.3	3.7	22	9.1	5.1	8.0
14	14.4		3.8	23	9.2	5.1	7.9
15	14.7	4.3	4.4	24	9.1	5.2	8.2
16	14.6	4.2	4.4	25	8.9	5.3	8.6
17	14.4	4.4	4.5	26	9.1	5.5	8.7
18	13.4	4.6	4.6	27	9.3	5.1	8.4
19	13.1	4.5	4.6	28	9.2	5.4	8.2
20	13.4	4.4	4.7	29	8.8	5.5	8.3
21	13.2	4.7	5.1	30	8.1	5.4	8.4
22	13.2	4.3	5.7	31	8.4	5.7	9.7
23	13.2	4.4	5.9	Aug. 1	8.1	5.8	9.9
24	13.2	4.1	6.1	2	6.5	6.0	10.5
25	13.3	4.3	6.0	3	6.9	5.8	10.6
26	12.8	4.4	5.8	4	9.0	5.3	10.5
27	12.8	4.6	5.6	5	7.3	5.8	10.5
28	12.3	4.5	5.3				

1/ Limit of Secchi-disc visibility in meters.

2/ On the Forel scale.

Color standards were carried by all catcher and exploratory boats of the fleet. These color standards were used in rating the water color on the Forel scale. The Secchi discs used by the Nippon Suisan fleet were all white and 30 cm. in diameter. The exploratory boats of this fleet carried electric thermometers with which surface water and subsurface temperatures were obtained.

FISHING OPERATIONS, METHODS, AND GEAR

MOTHERSHIP MOVEMENT: In a mothership-type fishery the catcher boats are entirely dependent on motherships for fuel, rations, and processing of catch. Furthermore, the cruising range of the catchers was restricted, as stated previously, for they were required to return to the mothership daily except when circumstances (e.g. net caught in screw) made this impossible. In view of these limitations, the success of catcher boats in catching salmon depended almost entirely upon the ability and judgment of the fishing experts whose job it was to situate the mothership in areas of salmon abundance.

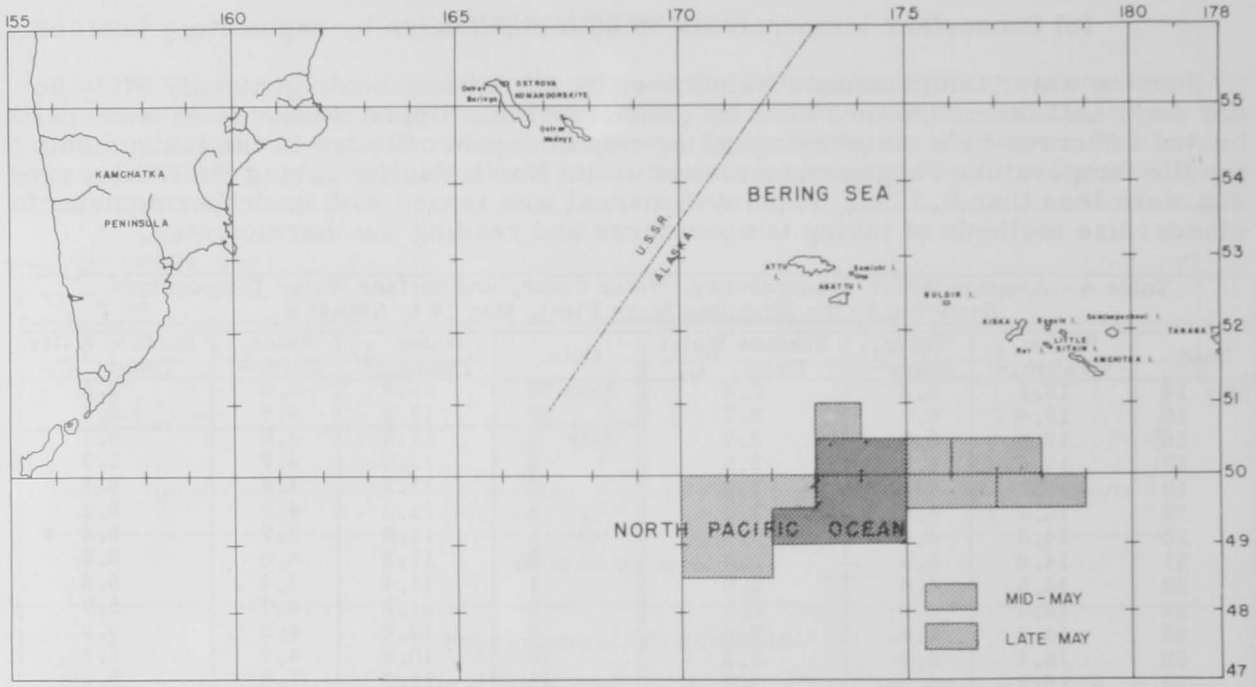

Fig. 4 - Fishing area during May.

Table 5 - Monthly Performance of the Miyajima Maru Fleet, 1954

Item	May	June	July	August	Total
Total days at fishing grounds . . .	17	30	31	17	95
Actual fishing days	13	28	29	17	87
Rest days	4	2	2	0	8
Boat days fished	433	923	947	558	2,861
Total tans fished	58,876	194,332	225,888	137,015	616,111
Average number of tans fished per day per catcher boat	136	211	239	246	215

Communication was an important factor in the deployment of the fleet and in determining areas to be fished. A communication schedule was maintained between catchers and motherships twice daily, from 1600 to 2000 hours (after the gear was set), and again at about 0400 hours (while the set was being, or had been, retrieved). In the evening, catchers reported position, direction of set, number of units set,

surface water temperature, water color, water transparency, and related meteorological data. In the morning schedule, the catchers reported progress in gear hauling, catch by species to that time, and the direction in which the fish were moving as ascertained from the face of the net in which the fish were "gilled." These data were inspected and analyzed by the fishing experts and collated with data from other sources. The fishing area for the day was determined as soon as the data were analyzed, this being very soon after morning reports of catchers were received. The following factors were considered in determining fishing grounds:

1. Experience gained from previous years of fishing with respect to the path of migration of salmon through the authorized fishing area.

2. Reports of the exploratory boats which operate a considerable distance away from the motherships.

3. The previous night's catch, e.g. direction of migration of salmon and abundance, size, and species composition of catch and stomach contents of samples from catch.

4. Performance of competing fleets and their positions; this is not only an ethical consideration, but also desirable because moving to areas occupied by other fleets leads to confusion and congestion of gear due to numbers and proximity of catchers.

5. Weather and sea conditions (regardless of the presence of fish, fleets cannot operate practicably when weather is very bad).

6. Position of mothership limited to authorized area.

7. Intuition is also considered to be a factor in deciding upon a fishing area.

FISHING GEAR: As in previous years, gill nets were used exclusively in this operation. A detailed diagram of a "tan" (one unit of gill net) is shown in fig. 2. All dimensions were converted from Japanese units to English equivalents where possible. For specifications of the cordage, a sample of the gear was examined by an experienced netmaker who provided descriptions for comparable American cord-

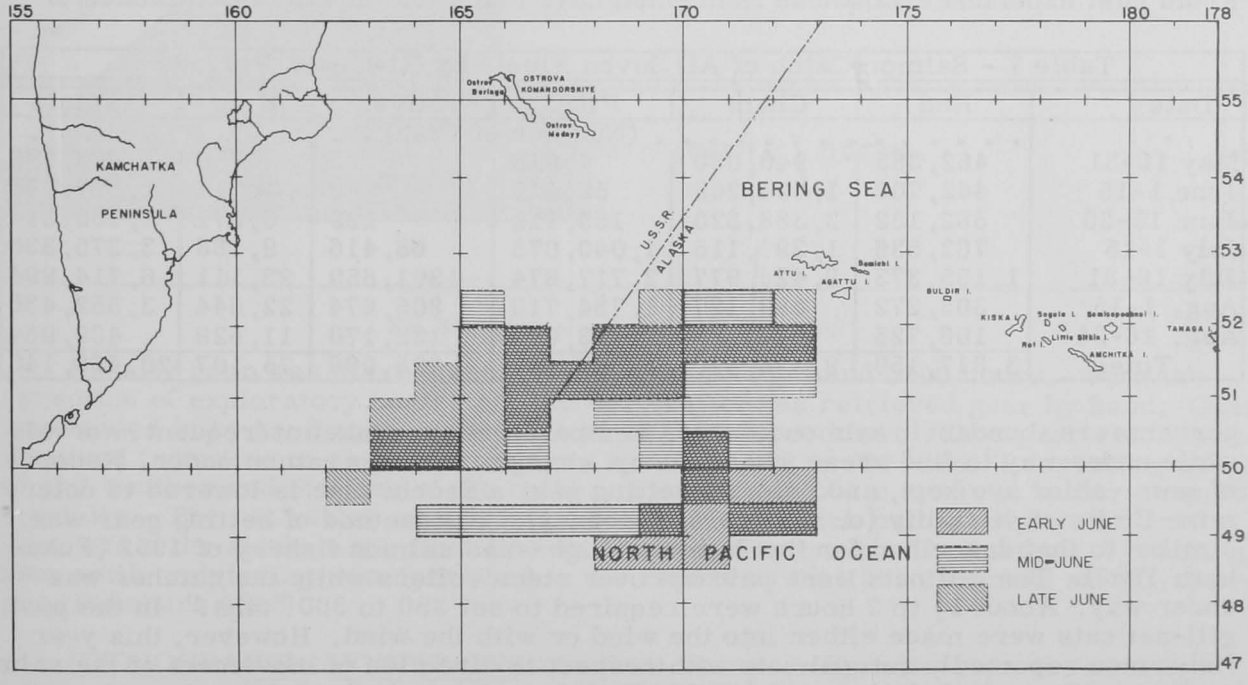

Fig. 5 - Fishing area during June.

age. The webbing is of a synthetic material bearing the trade name "Amilon." "Amilon" is very similar to nylon but reportedly has less stretch factor and good knot-holding qualities. The nets were fished in strings of from 200 to 300 "tans" (one unit of gill net), with each catcher and exploratory boat fishing such a string. The extensions of float and lead lines of adjoining units were linked and knotted. Webbing on the units were fastened by a cotton or nylon drop line, interlaced on the breast lines of adjoining units.

Table 6 - Cumulative Salmon Catch of All Seven Fleets by Species--Biweekly Totals

Date	Red	Chum	Pink	Silver	King	Total
	(Number of Fish)					
May 31	462,365	940,050	4,916	15	750	1,408,096
June 15	905,071	2,334,259	63,328	18	2,464	3,305,140
June 30	1,487,253	4,723,079	216,440	147	8,535	6,435,454
July 15	2,249,789	6,119,194	1,256,515	67,563	17,723	9,710,784
July 31	3,405,162	8,546,171	3,974,389	459,222	40,834	16,425,778
Aug. 15	3,710,434	9,229,298	5,709,108	1,265,896	63,478	19,978,214
Aug. 24	3,817,159	9,375,620	5,802,196	1,398,066	75,107	20,468,148

The color of most of the webbing used was raw sienna to burnt umber; however some catchers and exploratory boats used various colored webbing experimentally. In the opinion of the fishing experts, dark-gray webbing was better for fishing in the clear waters of the high seas and the color of the webbing of no apparent significance when fishing in the turbid waters nearer the coast of Kamchatka (western fishing area).

METHOD OF FISHING: When the mothership had determined the fishing area for the day, catcher boats were deployed around the mothership within a radius of 50 miles. Within this area catcher boats selected their own fishing areas.

On the high seas one very rarely sees visible signs of salmon or bait abundance, i.e. no "finners," "jumpers," or aggregations of birds. Therefore the fishermen depend almost entirely upon hydrographic conditions to locate areas for setting gear. From past experience Japanese fishermen have found that areas of confluence of

Table 7 - Salmon Catch of All Seven Fleets by Biweekly Periods

Date	Red	Chum	Pink	Silver	King	Totals
	(Number of Fish)					
May 16-31	462,365	940,050	4,916	15	750	1,408,096
June 1-15	442,706	1,394,209	58,412	3	1,714	1,897,044
June 15-30	582,182	2,388,820	153,112	129	6,071	3,130,314
July 1-15	762,536	1,396,115	1,040,075	68,416	9,188	3,275,330
July 16-31	1,155,373	2,426,977	2,717,874	391,659	23,111	6,714,994
Aug. 1-15	305,272	683,127	1,734,719	806,674	22,644	3,552,436
Aug. 16-24	106,725	146,322	93,088	132,170	11,629	489,934
Total	3,817,159	9,375,620	5,802,196	1,398,066	75,107	20,468,148

currents are abundant in salmon fishing. Temperatures are taken at frequent intervals while under way to find areas where abrupt changes in temperature occur. Records of water color are kept, and prior to setting gear a Secchi disc is lowered to determine limits of visibility (or water transparency). The method of setting gear was similar to that described for the Japanese high-seas salmon fishery of 1952 (Fukuhara 1953). The gill nets were paid out over stern rollers while the catcher was under way. About $1\frac{1}{2}$ to 2 hours were required to set 250 to 300 "tans." In the past, gill-net sets were made either into the wind or with the wind. However, this year fishermen reportedly set gill nets with respect to direction of movement of the salmon, regardless of wind direction (except in very strong wind). Salmon in the area

were thought to be migrating in an easterly or westerly direction, the latter predominating. Therefore gill nets were generally set in a northerly or southerly direction.

Experience of the Japanese in 1952 and 1953 indicated that in the clearer waters of the high-seas areas gear competition resulted unless the interval between gill nets was at least five miles. Therefore on extremely foggy days the mothership took bearings of all ships in the fleet and partially supervised the deployment of the catchers.

Figure 3 shows a sketch of a drift gill net in operation. All gear of the Nippon Suisan fleet was fished completely detached from the catcher boats. While the gear was "soaking," catcher boats maneuvered to keep the lights in sight. Light No. 1 was generally red. In addition to maintaining a position within sight of the light, the catcher boat remained clear of the gill net by keeping the white lights (lights #2 and #3) behind the red light. The number of "tans" between lights was changed with conditions of visibility. The radio buoy shown in the figure was used only by the exploratory boats. This was felt to be an excellent device for locating gear, however, its use on the gear of all catcher boats was thought to be impractical unless each catcher was assigned its own operating frequency.

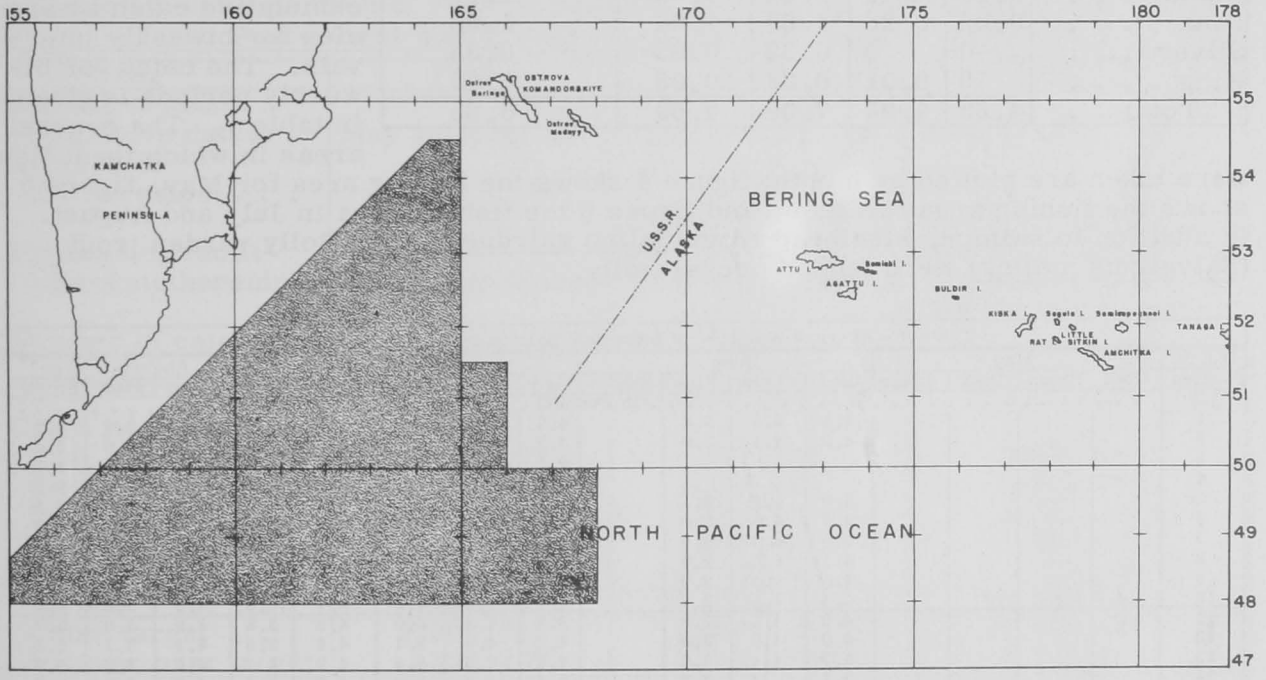

Fig. 6 - Fishing area during July and August.

Usually gear was started aboard between midnight and 0100 hours. With the exception of exploratory boats, all catcher boat crews retrieved gear by hand. Gear was hauled in by hand at the rate of 41 to 45 "tans" per hour. Thus gear retrieving required from five to seven hours (for a string of 200 to 300 "tans") depending upon the weather and the size of the catch. Exploratory boats used net haulers experimentally. The net hauler was in fact a line hauler, which pulled only on the lead line, while the slack in the float line was pulled in by hand. The method of handling gear while retrieving was described in the report on the 1952 Japanese salmon fishery (Fukuhara 1953).

HYDROGRAPHIC CONDITIONS: Surface water temperatures in the area in which the seven fleets operated during the 1954 fishing season ranged from 2.8° C.

(37° F.) in May to 11.8° C. (53.2° F.) in August. Water color for the same period was from 3 to 7 on the Forel scale, generally increasing with westward movement and advance in season. This corresponds in color to a range from bluish-green to yellow-green. Limit of Secchi-disc visibility increased from about 13 meters in mid-May to about 15 meters in early June, decreasing again to about 7 meters in August. The average surface water temperature, water color, and limit of Secchi-disc visibility, calculated from the daily log entries of the 33 catchers of the Miyajima Maru fleet, from May 14 to August 5, are listed in table 4.

A summary of the Miyajima Maru fleet's fishing schedule is given in table 5.

THE CATCH

During the 1954 season the combined fleets took a total of 20,468,148 salmon, of which 3,817,159 were red salmon (Oncorhynchus nerka), 9,375,620 chum salmon (O. keta), 5,802,196 pink salmon (O. gorbuscha), 1,398,066 silver salmon (O. kisutch), and 75,107 king salmon (O. tshawytscha). Table 6 shows the cumulative catch by species for biweekly intervals. The catch for biweekly periods is given in table 7. The general areas in which these fish were taken are plotted by month; figure 4 shows the fishing area for May, figure 5 shows the fishing area for June, and figure 6 the fishing area in July and August. In addition to salmon, steelhead trout (Salmo gairdnerii) and Dolly varden trout (Salvelinus malma) were landed occasionally.

Table 8 - Catch Per Unit of Effort--Miyajima Maru Fleet

Species	Number of Fish Per Tan For:				
	May	June	July	August	Entire Period
Red	1.47	1.13	2.23	0.69	1.47
Chum . . .	3.16	3.48	2.88	1.36	2.76
Pink	0.02	0.26	1.69	1.64	1.06
Silver . . .	0	0	0.32	0.95	0.33
King	0	0.01	0.03	0.05	0.03
Total . .	4.65	4.98	7.09	4.69	5.65

Table 9 - Average Weight[1/] of Individual Salmon by Species and Date

Month	May				June				July				August			
Species	Red	Chum	Pink	Silver	Red	Chum	Pink	Silver	Red	Chum	Pink	Silver	Red	Chum	Pink	Silver
Day	(In Pounds)															
1					4.5	4.4	2.8		4.7	4.2	2.8	4.8	4.7	4.2	3.0	5.5
2					4.0	4.1	3.0		4.7	4.3	2.9	4.8	4.7	4.7	3.0	5.5
3									4.5	4.3	3.0	4.6	4.6	4.2	3.0	4.6
4									4.6	4.4	3.2	4.8	4.2	4.1	3.0	5.3
5					5.0	4.3	2.8		4.8	4.3	2.8	5.1	4.3	4.1	3.0	5.5
6					4.9	4.3	3.0		4.5	4.2	2.7	4.9	4.0	4.2	3.1	5.2
7					4.0	4.3	2.9		4.5	4.3	2.8	4.3	4.6	4.1	3.2	5.2
8					4.1	4.1	2.8		4.3	4.4	2.9	4.9	4.1	4.0	3.0	5.2
9					4.0	4.1	2.9		4.6	4.3	2.8	4.6	4.1	4.2	3.0	5.7
10					4.1	4.1	2.7		4.1	4.3	2.9	4.7	4.0	4.5	3.0	5.4
11					4.0	4.1	2.8		3.7	4.2	3.0	4.8	3.6	3.9	3.0	5.7
12					4.0	4.2	3.0		4.2	4.6	3.1	4.8	3.5	4.1	3.1	5.5
13					4.7	4.1	3.0		4.3	4.3	3.0	4.9	3.5	4.8	3.2	5.4
14					5.1	4.3	3.2		4.1	4.3	3.0	4.9	3.4	4.2	3.2	5.6
15	4.6	4.9	2.3		4.5	4.3	2.5		4.2	4.4	3.1	4.9	3.5	4.0	3.1	5.6
16	5.0	4.8	2.5		4.5	3.6	2.9		5.3	4.4	2.9	5.1	3.6	4.0	3.2	5.6
17	5.0	4.8			5.0	4.4	3.2		4.5	4.4	3.3	5.0	3.4	4.1	3.1	5.7
18	5.0	4.9			4.9	4.3	3.1		5.1	4.7	3.1	4.9				
19	5.0	4.6	2.6		5.2	4.6	3.1		5.0	4.8	3.2	5.0				
20	5.2	4.7	2.5		5.2	4.4	2.6		4.8	5.0	3.0	4.7				
21	5.2	4.4	2.6		5.3	4.4	3.0		4.8	4.2	3.2	4.9				
22	4.8	4.7	2.5		5.6	4.5	3.1		4.7	4.1	3.0	4.7				
23	4.5	4.5	2.3		5.5	4.7	3.0		4.5	3.9	3.1	4.7				
24	4.5	4.2	2.3		5.1	4.3	3.0		4.5	4.2	3.1	4.7				
25					5.1	4.3	3.1		4.0	4.0	3.0	4.9				
26	4.7	4.3	2.7		5.0	4.7	3.2		4.2	4.2	3.0	5.0				
27					4.8	4.7	2.9		4.2	4.3	2.9	4.9				
28					4.8	4.5	2.8		4.7	4.6	3.2	5.0				
29		4.4	2.6		5.0	4.2	3.0		5.0	4.4	3.0	5.2				
30	5.0	4.4	2.9		5.1	4.4	3.0		5.0	4.7	3.0	5.0				
31	5.0	4.4	2.6						5.0	4.3	3.1	5.3				

1/ From samples of 100 fish.

A monthly summary of the catch per "tan" (one unit of gill net) of the Miyajima Maru fleet is shown in table 8. These figures must be considered only as rough indices of abundance due to variations in mesh size (which were not reported by catcher boats) and peculiarities in the reporting of effort statistics.

Personnel of the Nippon Suisan Co., Ltd. took average weights of salmon in the landings throughout the entire fishing period. These data are given in table 9. The average weights are based on samples of 100 fish of each species per day, specimens being selected at randon from the fish bins. Sampling was generally done at the close of the day's deck activities or after the last catcher boat of the day was unloaded.

CONCLUSION

The areas utilized by the 1954 Japanese high-seas salmon fleet were generally the same as those fished in 1952 and 1953. A comparison of certain pertinent features of the 1952, 1953, and 1954 high-seas salmon fisheries appears in table 10. In 1952 and 1953, three motherships participated in the fishery, and the entire catch was either frozen or salted. Four additional fleets entered the fishing in 1954, three of these equipped with canning facilities.

Table 10 - Comparison of Fishing Seasons, Facilities, and Performance of the Three Post-World War II Japanese High-Seas Salmon Expeditions

Item	1952	1953	1954
Fishing season (inclusive dates)	May 10-Aug. 10	May 10-Aug. 12	May 15-Aug. 23
Number of motherships	3	3	7
Processing facilities of motherships	Freezer & saltery	Freezer & saltery	Freezer, saltery, and two ships each with 2-line cannery, 1 ship with 1-line cannery.
Number of catcher boats 1/	60	105	194
	(Number of Fish)		
Catch by Species:			
Red	737,489	1,553,107	3,817,159
Chum	638,571	2,707,363	9,375,620
Pink	701,157	3,064,439	5,802,196
Silver	1,365	430,611	1,398,066
King	24,205	8,053	75,107
Total	2,102,787	7,763,573	20,468,148
Catch target	1,800,000	5,487,000	14,072,440
Number over target	302,787	2,276,573	6,395,708

1/ Approximate number.

The number of catcher boats was increased from about 60 in 1952 to about 105 in 1953. In both these years, gear with "rami" (China grass) webbing was used, with each catcher setting about 100 to 150 units of gear. With the increase in catcher boats, the 1953 fleet took 7,763,573 salmon, an increase of 5,660,786 fish from the initial year's (1952) operation. In 1954 the number of catcher boats was increased by about 90 over the previous year and 134 over 1952.

The number of units set per day per catcher boat in 1954 was almost twice that of the preceding two years. Webbing was changed from "rami" to "Amilon," the latter reportedly more efficient in catching fish. This increase in effort and change in webbing resulted in a total catch in 1954 of 20,468,148 salmon; which exceeded total salmon landings of 1952 and 1953 by 18,365,361 and 12,704,575, respectively. Sev-

veral factors may have contributed to the progressive increase in salmon landings in the three successive years:

1. Increase may reflect to some degree an increase in abundance of salmon in the areas fished by the fleets. However, accurate estimates of abundance cannot be made using data at hand.

2. Increased proficiency in fishing methods, improved gear, and further knowledge of the fishing area undoubtedly contributed to better performance by the fleets. Modification and improvement of gear is reportedly a factor.

3. The most obvious factor, however, seems to be the progressive increase in effort in the form of more catcher boats and more gear set by each catcher boat.

LITERATURE CITED

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FROZEN FOOD OUTLOOK FOR 1955

A good indication of the outlook for frozen food sales in 1955 is available to members of the fishing industry as a result of a recent nation-wide symposium of leaders in the frozen food field. The January 1955 Quick Frozen Foods carries articles by leaders in the field, which should be of interest and value to the fisheries trade.

Some of the titles include:

Bright but Watch Storm Warnings
Big Future for Prepared Foods
Warehouses Set to Meet Frozen Food Growth
Frozen Food Industry Faces a Good Year
Bright Year for Frozen Food Seen by Brokers
All Factors Point to Big Year
Bigger Volume Ahead at Better Profit
Frozen Seafoods Set for Record Year
Year of Rugged Normalcy is Ahead
Locker Plant Sales to Swing up
Frozen Foods Can't Miss in '55: Sales Bound to Rise
Quality is Keystone of Volume Growth
Growth to Lag Behind Potential
Better Prices, Good Market in 1955
Size of Record Year up to Packers
Quality is Decisive Factor for '55
Pack and Sales to Hit New High Records
Sales Outlook Tremendous for 1955
Quality, Prices, Keys to 1955 Growth
Plenty of Business to Go Around
Selling Effort Will Build Volume
Quality Biggest Factor in 1955
Closer Cooperation Will Help All
Frozen Foods Outlook Sound and Favorable
New Users to Make '55 Greatest Frozen Food Year
Price Stability is Big Challenge
Frozen on Way to 10% of All Food Sales