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CATCHES OF SOCKEYE SALMON OF BRISTOL BAY ORIGIN, 1978 and 1979  
AND CHINOOK SALMON OF WESTERN ALASKA ORIGIN  
BY THE JAPANESE MOTHERSHIP SALMON FISHERY, 1956-1979

by

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## INTRODUCTION

For many years, United States scientists estimated interceptions of North American salmon by the Japanese mothership salmon fishery. The estimates are derived from several kinds of information: age composition data for sockeye salmon; tag recovery data for pink, chum, and coho salmon; and scale patterns for chinook salmon. The estimates are made for specific  $2^{\circ} \times 5^{\circ}$  statistical areas, subareas, and time periods because catch statistics for the fishery are reported in that manner. The estimates are not as precise as desired. For example, there are gaps in our information on the distribution and intermingling of Asian and North American salmon in the fishing area, and some assumptions have been made to complete the analyses. However, the estimates are the best available at this time.

### Sockeye Salmon

At the time of the Japanese mothership fishery, sockeye salmon of Bristol Bay and Asian origin are intermingled in INPFC subareas 5 and 6 of the North Pacific Ocean and Bering Sea. Before 1978, the catch of Bristol Bay sockeye salmon in these subareas was estimated from the age composition of sockeye salmon originating from Bristol Bay and Asia; age composition of the catch was estimated from samples of sockeye salmon caught by the mothership fleets while they were in certain INPFC statistical areas (INPFC Bulletin 30, Table 3). Each catch was assumed to be entirely from Asia or Bristol Bay.

Beginning in 1978, age samples were no longer available from the fishery for immature and maturing fish of Asian and Bristol Bay origin. Because of changes in international agreements concerning fishing areas, the mothership fishery now operates in the area between  $170^{\circ}\text{E}$  and  $175^{\circ}\text{E}$  longitude. Before 1978, the fishing area spanned  $160^{\circ}\text{E}$ - $175^{\circ}\text{W}$  longitude.

Interceptions of immature and maturing fish of Bristol Bay origin for 1978 and 1979 are estimated from average interception rates in subareas and time periods (INPFC Bulletin 30) for the period 1960-76, as augmented by information in INPFC documents submitted at the annual meetings 1971-75 (R. A. Fredin, pers. comm.). Interceptions for 1978 and 1979 were estimated using the average interception rates for the appropriate cycle year of the Bristol Bay run, i.e. peak; pre-peak, post-peak, or mid-cycle (Tables 1 and 2).

### Chinook Salmon

Major et al. (1978) describe a procedure for estimating the percentage of western Alaska chinook salmon in the mothership catches from scale characters. Because samples available for such estimates for any one year are frequently small, the data have been pooled over several years (1966-72) to estimate the percentages of western Alaska chinook salmon in the various  $2^{\circ} \times 5^{\circ}$  statistical areas (Figure 1) by month (Table 3). It is concluded from these data that western Alaska chinook salmon are in all parts of the post-1977 mothership fishing area except statistical area 6048.

The averages of the monthly percentages given in Table 3 provide estimators of the annual interceptions of western Alaska chinook salmon. In addition to these interceptions, tag-recovery data indicate that North American chinook salmon of non-western Alaska origin are caught by the

mothership fishery between 175°W and 180°, south of the Aleutians, in statistical areas 8046, 8048, and 8050. For these statistical areas, I assumed that half of the chinook salmon that are not of western Alaska origin come from streams in Asia; the other half come from North American streams outside of western Alaska.

Ranking of the statistical areas in the order of magnitude of the interception of western Alaska chinook salmon (Figure 2; Table 5) reveals that the area of greatest interception is in the central Bering Sea, primarily east of 180° longitude and north of 56°N latitude. Nearly 42% of the total interceptions from 1956 to 1979 have come from only three statistical areas. In 1979, 50% of the total interceptions for that year were in the Bering Sea east of 180° longitude, outside the U.S. Fishery Conservation Zone.

#### ACKNOWLEDGEMENT

Much of the material presented herein came from the unpublished results of many years analyses by R. A. Fredin. I gratefully acknowledge his contribution to this report and his advice and encouragement, which furthered my understanding of the high seas salmon fisheries of Japan.

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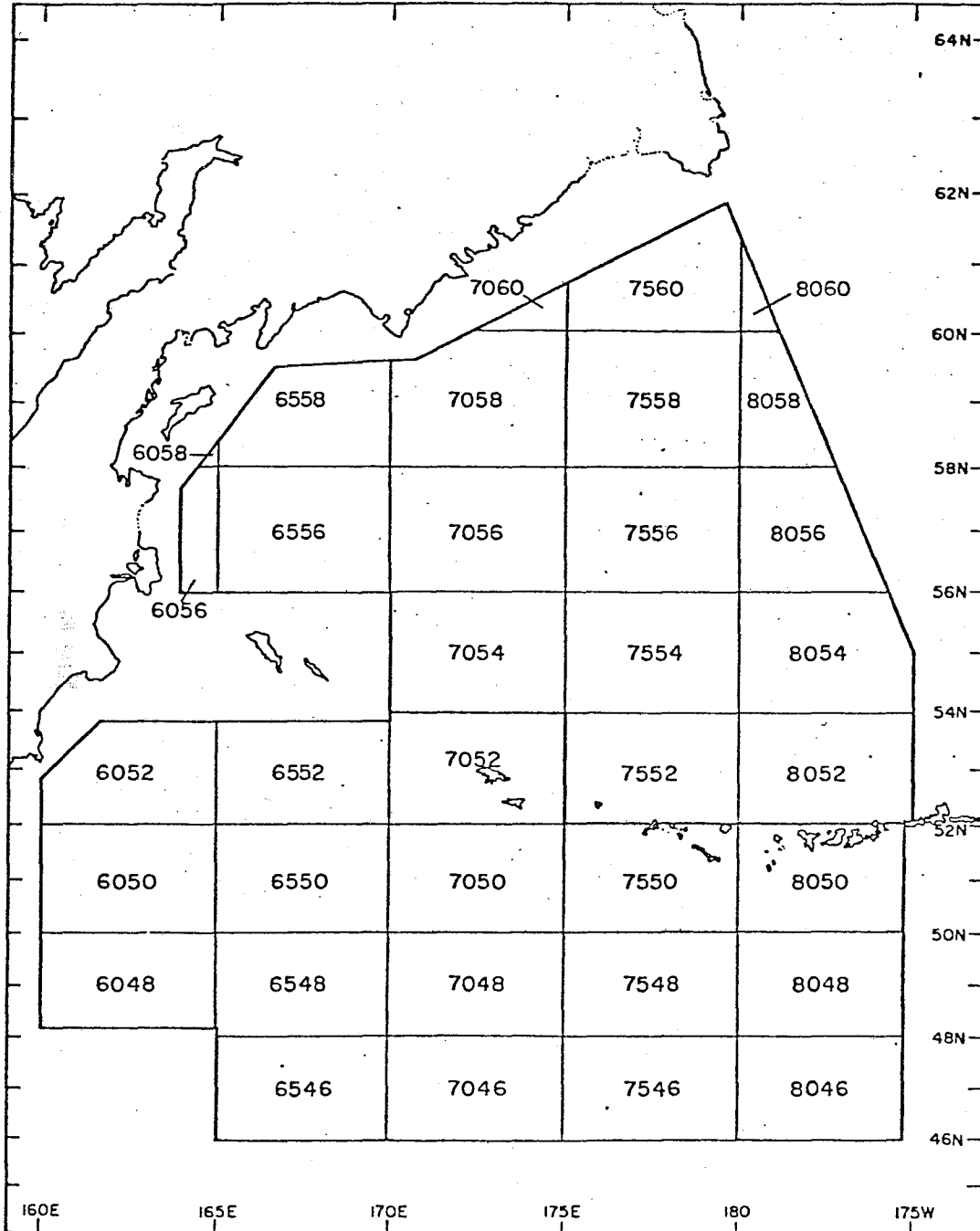


Figure 1. Japanese mothership salmon fishing area and statistical areas.

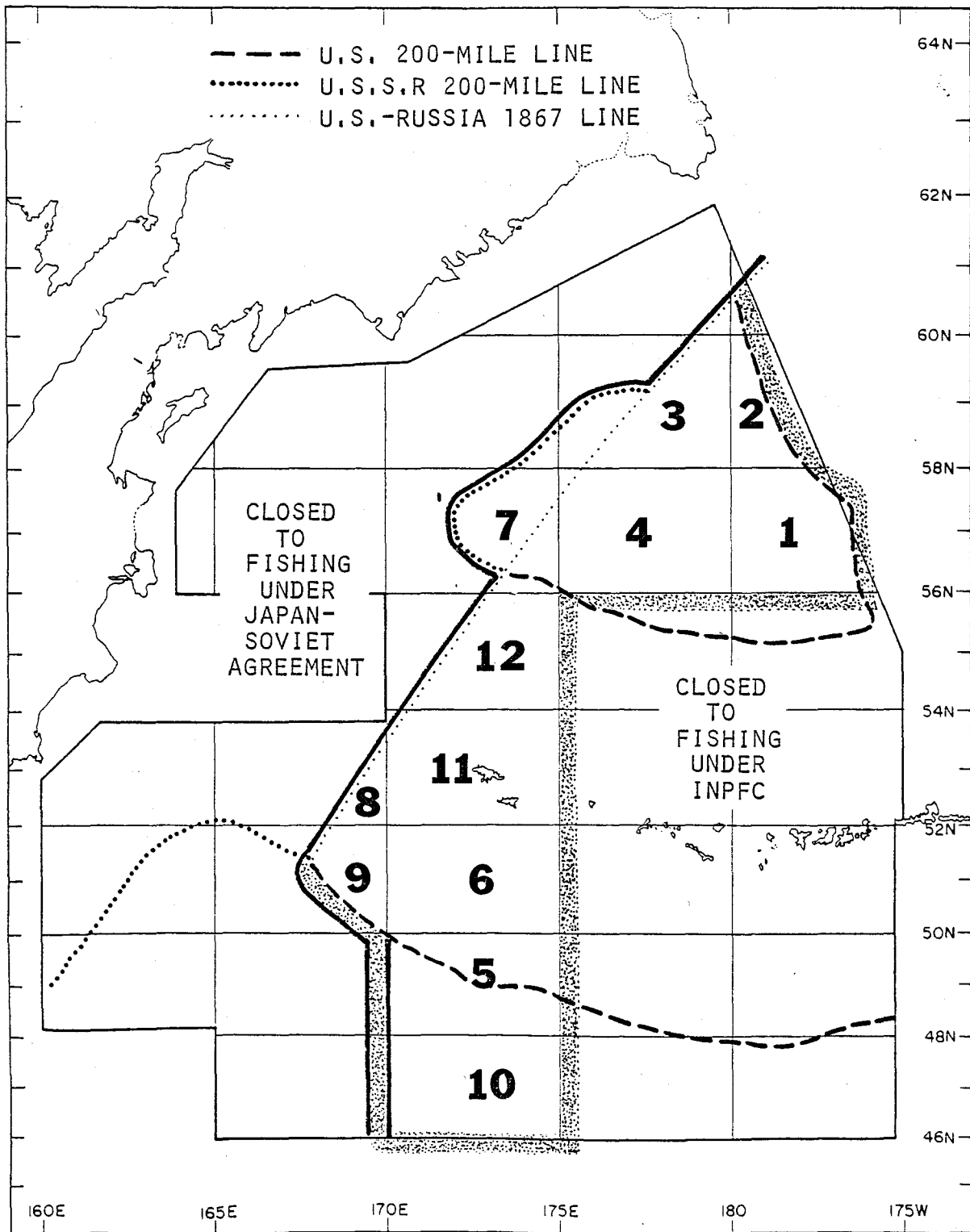


Figure 2. Post-1977 Japanese mothership salmon fishing area showing the rank order, from largest to smallest, of interceptions of western Alaska chinook salmon by  $2^{\circ} \times 5^{\circ}$  statistical area.

Table 1. Estimated catch (thousands of fish) of maturing and immature age .2 sockeye salmon of Bristol Bay origin by the Japanese salmon mothership fishery, 1956-1979.

Year	Catch by maturity category		Total
	Maturing	Immature	
1956	2,431	905	3,336
1957	6,444	11	6,455
1958	366	33	399
1959	565	87	652
1960	3,640	310	3,950
1961	5,819	127	5,946
1962	833	72	905
1963	929	60	989
1964	254	843	1,097
1965	6,100	404	6,504
1966	1,531	56	1,587
1967	866	21	887
1968	864	791	1,655
1969	1,240	517	1,757
1970	3,451	1,207	4,658
1971	842	592	1,434
1972	710	214	924
1973	625	259	884
1974	251	708	959
1975	645	222	867
1976	779	228	1,007
1977	540	328	868
1978	124	236	360
1979	68	410	478
Total	39,917	8,641	48,558
Average	1,663	360	2,023

Table 2. Estimated catch (thousands of fish) of maturing and immature age .2 sockeye salmon of Bristol Bay origin by the Japanese mothership salmon fishery, 1978-1979.

Subarea	1978		1979	
	Maturing	Immature	Maturing	Immature
5	70.5	233.6	67.9	339.2
6	16.3	1.4	0	17.0
8	34.7	0.6	0	12.2
10	1.9	0.6	0	41.6
Total	123.4	236.2	67.9	410.0



Table 3. Estimates of the percentages of western Alaska chinook salmon in catches by the Japanese mothership salmon fishery. (\* indicates no sample.)

Statistical area	Percent in pooled samples, 1966-1972			Average of monthly percentages <sup>a</sup>
	May	June	July	
6048	*	0	*	0
6050	*	2	8	5
6052	*	28	25	26
6056	*	*	*	(56)
6058	*	*	*	(69)
6546	13	13	*	13
6548	15	24	21	20
6550	*	29	18	24
6552	49	46	20	38
6556	*	*	56	56
6558	*	*	69	69
7046	18	24	0	14
7048	53	24	*	38
7050	33	41	*	37
7052	*	*	*	(37)
7054	*	25	*	25
7056	*	*	41	41
7058	*	*	79	79
7060	*	*	*	(79)
7546	*	55	40	48
7548	*	*	57	57
7550	*	83	*	83
7552	*	*	*	(70)
7554	*	70	*	70
7556	*	32	*	32
7558	*	74	80	77
7560	*	81	65	73
8046	*	*	83	83
8048	92	54	78	75
8050	*	87	*	87
8052	*	100	*	100
8054	*	100	*	100
8056	*	97	100	98
8058	*	97	92	94
8060	*	*	*	(94)

a. Figures in parentheses are averages for adjacent statistical areas: 6056/6556, 6058/6558, 7052/7050, 7070/7058, 7552/7554, and 8060/8058.

Table 4. Estimates of the annual interceptions (in thousands of fish) of western Alaska chinook salmon in catches by the Japanese mothership salmon fishery, 1956-1979.<sup>a</sup> (+ indicates 1-99 fish.)

Statistical area	Year												
	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
6048	0	0	0	0	0	0	0	0	0	0	0	0	0
6050	0.4	0.1	0.4	0.2	0.2	+	0.2	0.2	+	0.1	+	0.2	+
6052	1.0	0.8	0.5	0.3	0.3	+	0.5	1.3	0.8	1.0	0.3	1.3	0.8
6056	0	0	0	0	0	0	0	+	+	+	+	+	0.6
6058	0	0	0	0	0	0	0	0	0	0	+	0	0
6546	1.0	+	0.8	0.4	0.1	+	3.4	+	0.6	0.8	0.3	0.1	0.3
6548	0.6	+	1.0	2.0	1.2	1.0	5.2	1.0	2.4	1.0	1.8	1.0	1.2
6550	0.2	0.5	1.2	1.4	1.0	0.7	4.3	1.7	1.0	2.2	2.2	2.6	1.4
6552	0.8	0.4	0.4	0.8	1.1	0.4	3.4	0.8	1.1	4.2	2.7	2.3	2.3
6556	+	+	0	+	2.2	0	0	+	1.7	5.6	11.2	+	0.5
6558	+	+	0	0.7	3.4	+	0	4.1	9.7	6.2	16.6	6.9	9.0
7046	2.0	0	+	0.1	1.3	+	0.8	0.1	4.3	1.8	3.9	1.1	0.3
7048	2.3	+	+	1.1	1.5	0.8	6.8	1.1	19.0	1.1	4.2	2.3	2.3
7050	1.1	0.7	0.7	0.7	0.4	0.7	2.2	2.2	1.5	1.1	1.1	1.5	3.0
7052	0.7	0.4	0.4	0.7	+	+	0.4	+	0.4	1.1	0.7	0.4	0.7
7054	+	+	0	0.2	0	+	0	+	+	0.5	0.2	+	0.2
7056	+	+	0	2.0	0	+	0	0.4	0.8	4.1	0.8	0.4	13.1
7058	0.8	+	0	13.4	8.7	+	0	7.1	45.8	14.2	7.1	10.3	26.1
7060	0	0	0	0	0	0	0	+	+	+	+	0.8	+
7546	+	0	0	0	0	0	0	+	0.5	3.8	1.9	+	1.4
7548	0.6	0	+	+	0	+	+	1.1	23.9	+	1.1	0.6	0.6
7550	0.8	+	0	+	0.8	0.8	1.7	0.8	5.8	0.8	0.8	1.7	5.8
7552	3.5	1.4	0	0	1.4	0.7	+	0.7	+	2.1	1.4	2.1	+
7554	2.1	0.7	0	0	+	0	0	+	+	0.7	0.7	+	2.1
7556	0	+	0	+	1.0	0	0	0	1.0	1.6	3.8	1.0	15.0
7558	0	1.5	0	3.1	5.4	0	0	1.5	52.4	5.4	3.1	10.0	55.4
7560	0	0	0	0.7	2.1	0	0	13.9	9.5	10.2	5.1	5.1	21.9
8046	0	0	0	0	0	0	0	0	+	+	0	0	6.6
8048	0.7	0	0	0	0	0	+	0	8.3	+	1.5	0	1.5
8050	0.8	0	0	0	+	0.8	0.8	+	23.4	+	1.8	0.8	2.6

Table 4. Continued.

Statistical area	Year												
	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
8052	20.0	+	0	0	6.0	5.0	0	+	+	+	11.0	+	+
8054	14.0	2.0	0	0	14.0	3.0	0	+	+	1.0	5.0	4.0	2.0
8056	1.0	3.9	0	0	26.5	+	0	0	12.7	4.9	12.7	4.9	27.4
8058	0.9	2.8	0	0	55.5	0	0	+	25.4	29.1	8.5	7.5	13.2
8060	0	0	0	0	0.9	0	0	2.8	0.9	0.9	+	0.9	+
Total	55.4	15.2	5.4	27.8	135.0	13.9	29.7	40.8	252.9	105.5	111.5	69.8	226.3

a. Obtained by multiplying the annual mothership catches in the statistical areas by the indicated estimates of the percentages of western Alaska chinook salmon in Table 3.

Table 4. Continued.

Statistical area	Year											Total	Average
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979		
6048	0	0	0	0	0	0	0	0	0	0	0	0	0
6050	0.3	0.1	0.1	+	0.2	0.1	+	0.6	+	0	0	3.2	0.1
6052	1.6	0.8	+	1.3	1.0	0.5	1.0	1.6	0	0	0	16.7	0.7
6056	0.6	+	+	1.7	0.6	1.7	+	0.9	0	0	0	6.1	0.3
6058	+	0	0	+	0	0	+	0	0	0	0	+	0
6546	0.1	+	0.3	1.0	0.4	0.1	0.3	0.9	+	0	0	10.9	0.5
6548	0.4	0.4	0.4	1.0	3.8	0.6	0.6	2.0	0.6	0	0	30.4	1.3
6550	0.7	0.7	1.2	1.0	1.4	1.0	0.5	0.9	0.3	0.2	0.2	28.5	1.2
6552	4.2	0.4	1.1	0.4	0.8	0.8	0.4	1.5	+	0.3	+	30.6	1.3
6556	1.1	+	1.7	2.2	0.6	3.9	5.0	6.2	0	0	0	50.9	2.1
6558	10.4	2.8	2.1	2.8	1.4	1.4	5.5	5.2	0	0	0	88.2	3.7
7046	1.0	+	0.1	0.1	0.7	0.1	0.8	0.6	0.2	0.9	0.6	21.8	0.9
7048	1.1	0.4	0.8	1.1	1.1	5.7	1.1	1.8	2.4	12.0	2.4	72.4	3.0
7050	1.5	1.1	1.5	0.7	1.1	2.2	0.4	0.9	2.7	9.4	15.2	51.6	2.2
7052	0.7	0.4	1.1	+	0.7	0.4	+	+	0.2	1.5	1.6	12.5	0.5
7054	0.2	+	2.8	0.2	0.2	0.5	+	0.9	0.4	0.5	0.7	7.5	0.3
7056	3.7	0.8	1.6	5.3	0.4	0.8	3.7	1.5	+	0.2	0.2	39.8	1.7
7058	11.8	37.9	7.9	12.6	2.4	2.4	18.2	12.1	0	0	0	238.8	10.0
7060	+	4.0	+	+	+	0	0	+	0	0	0	4.8	0.2
7546	8.2	+	0.5	+	1.4	0.5	4.3	5.5	0.7	0	0	28.7	1.2
7548	6.3	1.7	5.7	0.6	1.1	12.5	2.8	14.4	6.0	0	0	79.0	3.3
7550	1.7	3.3	2.5	0.8	4.2	24.9	1.7	17.5	3.0	0	0	79.4	3.3
7552	0.7	1.4	2.1	0.7	1.4	4.9	0.7	1.2	2.2	0	0	28.6	1.2
7554	9.1	1.4	1.4	1.4	2.1	4.9	1.4	1.6	1.1	0	0	30.7	1.3
7556	3.2	12.2	2.6	10.6	1.3	5.1	1.6	2.8	1.6	1.0	11.0	76.4	3.2
7558	25.4	65.4	28.5	26.2	1.5	19.2	5.4	8.2	2.8	0.5	0.7	321.6	13.4
7560	67.9	27.0	3.6	31.4	+	+	0	+	0	0	0	198.4	8.3
8046	17.4	+	+	+	+	+	5.0	2.1	0.4	0	0	31.5	1.3
8048	3.8	0.7	3.0	0.7	+	6.7	+	8.4	+	0	0	35.3	1.5
8050	0.8	7.8	3.5	+	1.8	20.0	0.8	11.8	1.7	0	0	79.2	3.3
8052	5.0	25.0	3.0	1.0	+	9.0	+	10.7	0.2	0	0	95.9	4.0

Table 4. Continued.

Statistical area	Year											Total	Average
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979		
8054	78.0	16.0	5.0	4.0	1.0	66.0	3.0	9.3	5.1	0	0	232.4	9.7
8056	95.1	86.2	31.4	39.2	8.8	87.2	8.8	19.2	20.8	4.8	29.9	525.4	21.9
8058	70.5	47.0	27.3	21.6	5.6	3.8	35.7	17.5	12.1	+	2.5	386.5	16.1
8060	2.8	+	0.9	+	0	0	0	+	0	0	0	10.1	0.4
Total	435.2	344.8	143.6	169.5	47.0	286.8	109.2	167.7	64.5	31.3	65.0	2953.8	123.1

Table 5. Ranking of 2° x 5° statistical areas in which western Alaska chinook salmon were intercepted by the Japanese mothership salmon fishery, 1956-1979. (\* indicates area was open to fishing after 1977.)

Rank	INPFC area	Interceptions			
		Total (thousands)	%	Cumulative total (thousands)	Cumulative %
1	8056 *	525.4	18	525.4	18
2	8058 *	386.5	13	911.9	31
3	7558 *	321.6	11	1233.5	42
4	7058	238.8	8	1472.3	50
5	8054	232.4	8	1704.7	58
6	7560	198.4	6	1903.1	64
7	8052	95.9	4	1999.0	68
8	6558	88.2	3	2087.2	71
9	7550	79.4	2	2166.6	73
10	8050	79.2	3	2245.8	76
11	7548	79.0	3	2324.8	79
12	7556 *	76.4	2	2401.2	81
13	7048 *	72.4	3	2473.6	84
14	7050 *	51.6	1	2525.2	85
15	6556	50.9	2	2576.1	87
16	7056 *	39.8	2	2615.9	89
17	8048	35.3	1	2651.2	90
18	8046	31.5	1	2682.7	91
19	7554	30.7	1	2713.4	92
20	6552 *	30.6	1	2744.0	93
21	6548	30.4	1	2774.4	94
22	7546	28.7	1	2803.1	95
23	7552	28.6	<1	2831.7	96
24	6550 *	28.5	<1	2860.2	97
25	7046 *	21.8	<1	2882.0	98
26	6052	16.7	<1	2898.7	98
27	7052 *	12.5	<1	2911.2	99
28	6546	10.9	<1	2922.1	99
29	8060	10.1	<1	2932.2	99
30	7054 *	7.5	<1	2939.7	99
31	6056	6.1	<1	2945.8	99
32	7060	4.8	<1	2950.6	99
33	6050	3.2	<1	2953.8	100
34	6058	a	<1	2953.8	100
35	6048	0	0	2953.8	100
Total		2953.8	100		

a. 1-99 fish