NOAA Technical Memorandum NMFS-F/AKR-1

doi:10.7289/V5/TM-F/AKR-1

The Japanese High Seas Mothership Salmon Fishery in the North Pacific Ocean:

The Economic Implications of a Loss of INPFC Constraints

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
National Marine Fisheries Service

THE JAPANESE HIGH SEAS MOTHERSHIP SALMON FISHERY IN THE NORTH PACIFIC OCEAN: the economic implications of a loss of INPFC constraints

by

Lewis E. Queirolo

March 1982

National Marine Fisheries Service
Alaska Region
Juneau, Alaska

TABLE OF CONTENTS

ABSTRACT

The development and eastward expansion of the Japanese High Seas Mothership Salmon fishery in the North Pacific and Bering Sea was responsible for the establishment of the International Convention of the High Seas Fisheries of the North Pacific Ocean. The Convention was, as it remains to date, a tri-national agreement between the United States, Canada, and Japan intended to guarantee the interests of each nation in the fisheries of the North Pacific.

The Japanese have had a long history of fishing activities in the region. However, with the advent of the Magnuson Fishery Conservation and Management Act, the Marine Mammal Protection Act, and a 1980 fishery in which Japan acknowledged an exceptionally high interception of North American chinook salmon, questions have arisen as to the desirability of continued U.S. participation in the Convention. This report attempts to answer this question by examining the potential economic impacts which might be incurred by North American salmon fishermen should the Convention be revoked by the U.S.

Utilizing recent historical Japanese catch rates, stock composition and age data, and three possible operational scenarios which Japan might reasonably be expected to undertake absent the Convention's constraints, it appears that, in the worst case, Japanese interceptions of North American

salmon could increase to as many as 26.8 million fish annually with a discounted value to the the U.S. fishery of $128.2 million per year.

I. INTRODUCTION

Japan is a densely populated island nation with meager terrestrial resources. As a result, Japan has been forced to turn outward to seek the raw materials necessary to sustain its people. Not surprisingly perhaps, the Japanese have evolved a particularly intimate dependence upon the living resources of the sea, exhibited by the highest per capita consumption of fish and shellfish of any nation on earth.[1/] The Japanese have also ranked, historically, among the leading nations in the world in terms of international trade in fisheries products.

With a long history of fishing activity in the North Pacific Ocean, the Japanese began harvesting salmon on the high seas in the early part of the 20th century. Except for the period surrounding World War II, Japan has continued to depend heavily upon this high seas salmon harvest to the present.

In 1952, the Japanese expanded this fishery eastward and, for the first time, began commercial high seas operations in the Alaska region just south of the Aleutian chain.[2/] The Japanese employed small catcher boats in combination with

---

1/ Fisheries of the United States, 1980, Current Fishery Statistics No. 8100, U.S. Dept. of Commerce, NOAA, NMFS, April 1981.

2/ Chitwood, P.E., Japanese, Soviet, and South Korean Fisheries Off Alaska, Development and History Through 1966; Circular 310, U.S. Dept. of Interior, Fish & Wildlife Service, Bureau of Commercial Fisheries.

larger factory vessels. These large vessels, or "motherships," served both as floating processors of the salmon catch and support vessels to the small catcher fleet, permitting extended high seas operations far from Japanese ports.

In that same year, the United States, Canada, and Japan began work on a treaty governing the exploitation and management of fishery stocks of mutual interest to the three countries. This treaty, entitled the International Convention of the High Seas Fisheries of the North Pacific Ocean, commonly referred to as the INPFC, was entered into force in 1953. The Convention's center piece was the "abstention principle" under which the signatories agreed not to enter fisheries in which stocks were fully utilized under a maximum sustainable yield management system. The treaty further established a governing commission made up of representatives from each of the three nations and responsible for studying stocks in the Convention area and recommending "joint conservation measures" to the signatories.

Under INPFC the Japanese high seas mothership salmon fishery was restricted to areas west of 175°W longitude, principally in order to protect United States and Canadian interests in North American salmon stocks. Since the Japanese had not historically fished east of 175°W the Convention did not impact their existing fishing pattern. Its effect was to

preclude further eastward expansion nearer the North American mainland (see Figure 1).

A Protocol to the 1952 INPFC was negotiated by the United States, Canada, and Japan in 1977-78 after the passage of the U.S. Magnuson Fishery Conservation and Management Act. The Protocol authorized Japan to fish for salmon inside the newly established U.S. 3-200 mile fishery conservation zone (FCZ) in return for limitations on Japanese fishing efforts beyond the U.S. FCZ. It further shifted the easternmost limit of the Japanese high seas fishery from 175°W to 175°E longitude south of 56°N latitude, a marked reduction in the range of this fleet. The primary purpose of the agreement continued to be the desire to allow Japan the opportunity to carry on its traditional harvest of salmon of Asian origin, principally chum salmon, while minimizing the interceptions of North American stocks, especially Bristol Bay sockeye.

Recently there have arisen questions as to just how great an impact the Japanese mothership salmon fishery has on North American, and particularly western Alaskan, salmon fisheries under INPFC regulation; and what might occur if the INPFC were terminated. The following analysis has been conducted in an effort to examine these important concerns.

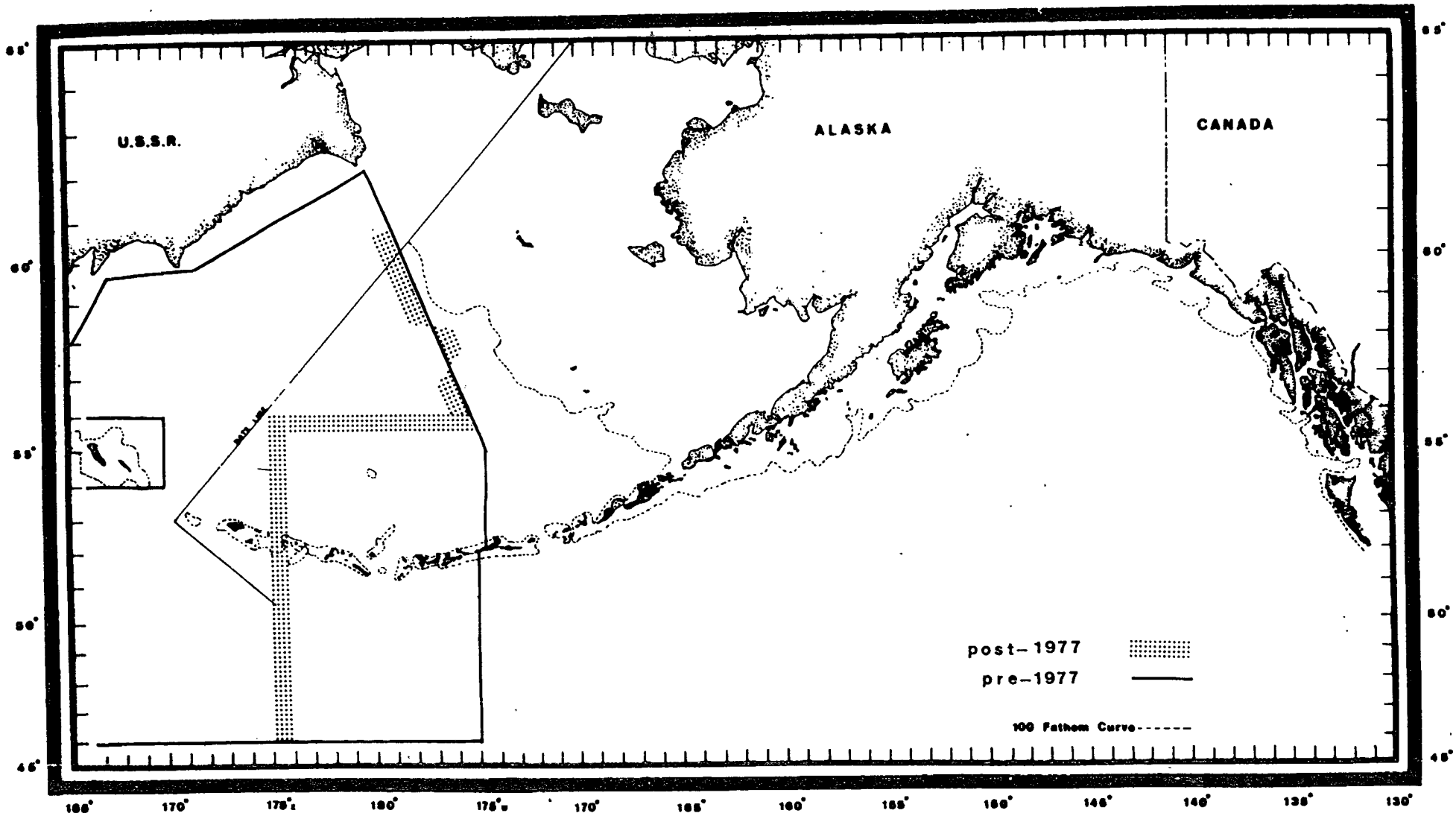


Figure 1. Eastern Boundary of High Seas Mothership Salmon Fishery Under Original INPFC and Subsequent Protocol.

II. THE SCOPE AND IMPACT OF THE JAPANESE MOTHERSHIP FISHERY

The 1977-78 INPFC Protocol resulted in a Japanese high seas mothership salmon fleet consisting of 4 factory vessels and 172 catcher boats. This was down from pre-1977 averages of 10 motherships and 332 catchers. In 1980 this fleet fished an average of 330 "tans" of net per set per catcher boat for a cumulative season total of 3.1 million "tans", only slightly more than either of the previous 2 years.3/

Estimates derived from several sources, including age composition data for sockeye salmon, tag recovery data for pink, chum, and coho salmon, and scale pattern analysis for chinook salmon, indicate that under the Protocol agreement eliminating Japanese salmon fishing east of 175°E and south of 56°N, virtually all North American salmon intercepted in the mothership fishery are destined to return to western Alaska. Figure 2 illustrates the magnitude of the Japanese mothership fleet's annual "physical" impact on North American sockeye, chinook, and chum salmon, 1975 through 1980.4/ Pink and coho salmon of North American origin are assumed not to be present in this fishery.

3/ A "tan" of gillnet measures approximately 50 meters in length. The Japanese are limited by agreement to fish a length of a driftnet, set by one catcher boat, of a maximum of 15 kilometers, or 9.323 miles.

4/ Proportions of North American salmon taken from Friden, et al., 1977 Pacific Salmon and the High Seas Salmon Fisheries of Japan, NWC Processed Report, 324 p.

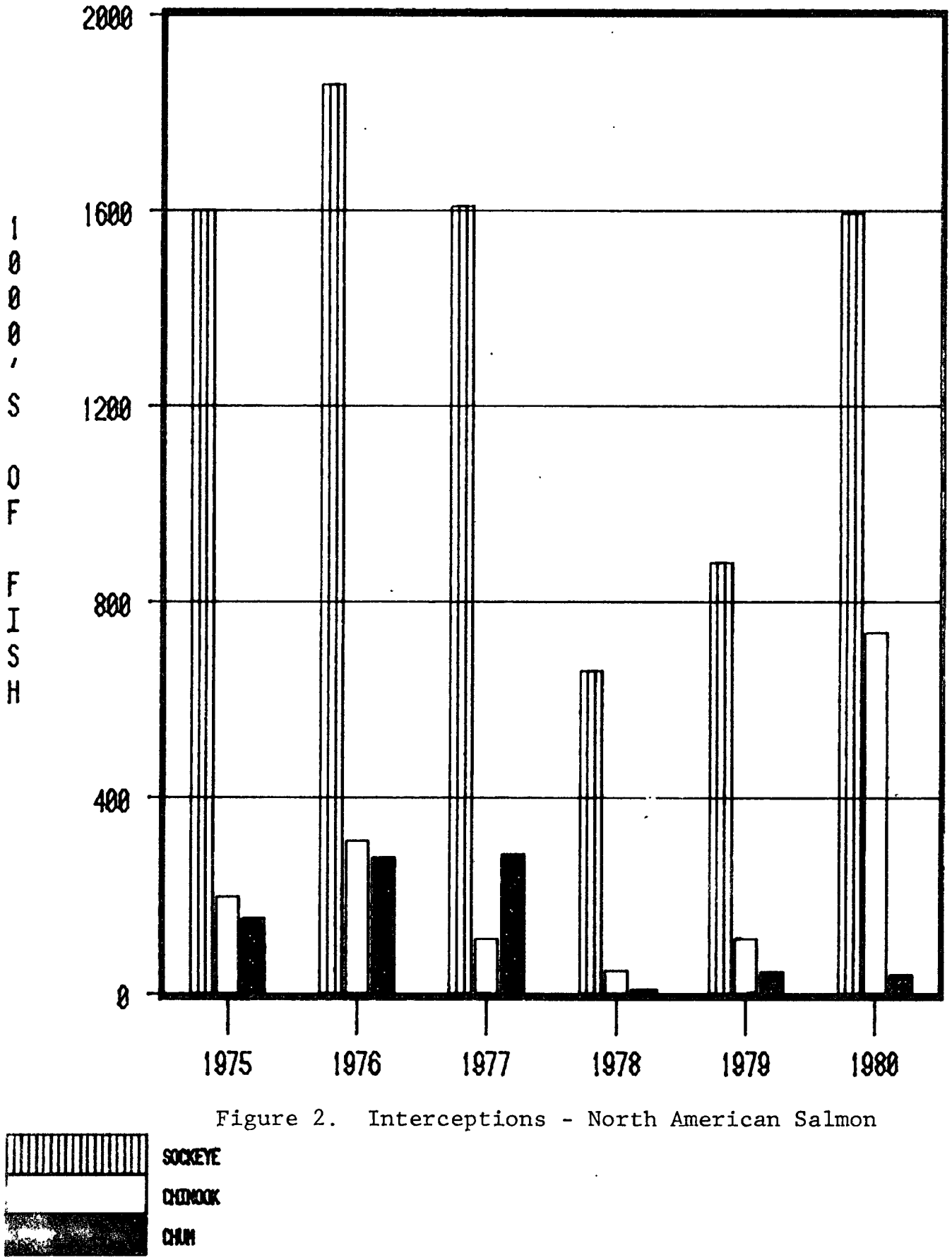


Figure 2. Interceptions - North American Salmon

The reported Japanese annual "catch" of North American salmon by species is believed to seriously understate the mothership fleet's actual impact on North American stocks. Research into noncatch mortality caused by fishing, referred to as dropout loss, demonstrates that substantially greater numbers of fish are killed in Pacific Ocean salmon fisheries than are actually landed.[5/] Therefore, the more appropriate indicator of the total physical impact on North American salmon stocks by the Japanese is "interceptions", i.e. reported catch plus dropout loss (Table 1). Throughout the present analysis dropout loss has been assumed to be one in four fish for maturing salmon (fish in their final ocean year) and one in two fish for immature salmon.[6/] That is, for every three maturing salmon of North American origin reported to have been taken by the Japanese, one additional maturing North American fish was killed but lost. Similarly, the reported Japanese catch of immature North American salmon reflects only one-half of the actual total kill of these same stocks. Based upon recent historical information the maturity composition of the Japanese take has been assumed to be as follows: 90 percent of intercepted North American chinook salmon are immature, and are equally divided among fish 1, 2, and 3 years away from domestic commercial

---

5/ Ricker, 1976, Review of the rate of Growth and Mortality of Pacific Salmon in Saltwater and Noncatch Mortality Caused by Fishing, J. Fish. Res. Board Canada, Vol. 33 pp. 1483-1524.

6/ Ricker, *ibid.*

Table 1: Physical Impacts on North American Salmon.

	Japanese Mothership Fleet Estimated Catch (1000's fish)	Japanese Mothership Fleet Interceptions (1000's fish) 1/	U.S. Domestic Catch Loss 1/,2/ (1000's fish)	(1000 lbs.)
		North American Sockeye		
1975	864.0	1,612.8	1,474.5	8,847.0
1976	1,001.0	1,868.5	1,708.3	10,249.8
1977	868.0	1,620.3	1,481.3	8,888.0
1978	360.0	672.0	614.4	3,686.3
1979	478.0	892.3	815.8	4,984.5
1980	861.0	1,607.2	1,469.4	8,816.3
		North American Chinook		
1975	109.0	210.7	174.0	4,177.0
1976	168.0	324.8	268.3	6,437.9
1977	65.0	125.7	103.8	2,490.9
1978	31.0	59.9	49.5	1,187.9
1979	65.0	125.7	103.8	2,490.9
1980	380.0	734.6	606.7	14,561.3
		North American Chum		
1975	126.0	168.0	168.0	1,175.7
1976	218.0	290.6	290.6	2,034.2
1977	223.0	297.3	297.3	2,080.8
1978	8.0	10.7	10.7	74.7
1979	43.0	57.3	57.3	401.2
1980	39.0	52.0	52.0	363.9

1/ Assumes 1 in 4 dropout loss for maturing; 1 in 2 dropout loss for immatures.

2/ Assumes 10 percent annual mortality.

Source: Dr. Michael Dahlberg.

fisheries; 80 percent of intercepted North American sockeye salmon are immature and are all 1 year away from domestic commercial fisheries; 100 percent of intercepted North American chum salmon are maturing. The importance of including dropout loss in evaluating the actual impact on North American stocks can be seen, for example, in the 1980 chinook statistics. The estimated Japanese mothership catch of North American chinook in 1980 was reported to be 380,000 fish while, in fact, evidence indicates that more than 734,000 North American chinook were intercepted, i.e. killed, in this fishery.[7/]

A natural mortality rate of 10 percent per year for immatures has also been uniformally assumed. Therefore, as an example, while 1,620,300 North American sockeye were intercepted in the 1977 Japanese mothership fishery, the total associated loss to domestic fishermen was 1,481,300 fish.[8/]

Average weight per fish in the domestic fishery was assumed to be 24 pounds for chinooks, 6 pounds for sockeye, and 7 pounds for chums. These weights are based upon historic averages from western Alaska domestic catches.[9/]

7/ Personal communication, Dr. Michael Dahlberg, NMFS.

8/ Assumes all North American salmon intercepted by Japanese mothership fleet would have been available to domestic fishermen minus natural mortality losses.

9/ Source: Alaska Department of Fish and Game.

Utilizing the U.S. domestic catch losses reported in columns four and five of Table 1, and assuming constant real exvessel prices in the western Alaska fisheries of $1.00/lb. for chinook, $.85/lb. for sockeye, and $.55/lb. for chums, a non-discounted loss of gross exvessel revenues was estimated, by species, for 1975 through 1980 (Table 2). However, these non-discounted losses of gross earnings tend to overstate the true exvessel economic impact on the domestic fishery. A more appropriate estimate of this loss is obtained by discounting the income stream to its present value. This procedure is necessary, except in the case of chums, because not all of the North American fish lost to Japanese interceptions in any one year would have returned to the domestic fishery in that year. For example, while the non-discounted loss to U.S. fishermen for sockeye in 1980 appears to be $7,493,850 (Table 2), in fact, some of those fish intercepted by the Japanese in 1980 would not have entered the domestic fishery until 1981 and are therefore less valuable, *ceteris paribus*. Assuming constant real prices and a real annual discount rate of 3 percent, the actual loss to the domestic sockeye fishery at the exvessel level is $7,309,680. Referring to the last column of Table 2, the aggregate discounted present value of the exvessel loss to U.S. salmon fishermen ranges from a 1978 low of $4,225,240 to a 1980 high of $21,468,760. The 6-year average annual discounted loss under INPFC has been approximately $11,816,000.

Table 2

Loss of Gross Exvessel Revenue to U.S. Salmon
Fisheries Associated with Japanese Mothership Interceptions
(1,000 dollars)

	Chinook		Sockeye		Chum		Total*	
	Non-discounted	Discounted[1/] Present Value	Non-discounted	Discounted[1/] Present Value	Non-discounted	Discounted[1/] Present Value	Non-discounted	Discounted[1/] Present Value
1975	4,176.97	3,965.74	7,519.96	7,335.15	646.54	646.64	12,343.60	11,947.50
1976	6,437.89	6,112.34	8,712.36	8,498.25	1,118.79	1,118.79	16,269.00	15,729.40
1977	2,490.85	2,364.89	7,554.78	7,369.11	1,144.45	1,144.45	11,190.10	10,878.40
1978	1,187.94	1,127.87	3,133.32	3,056.31	41.06	41.06	4,362.32	4,225.24
1979	2,490.85	2,364.89	4,160.35	4,058.10	220.68	220.68	6,871.88	6,643.67
1980	14,671.19	13,959.03	7,493.85	7,309.58	200.15	200.15	22,365.19	21,468.76

* North American Coho's and Pinks assumed not to be present in Japanese Mothership Area defined by INPFC.

1/ Assumes constant real price, 3 percent real annual discount rate.

Under the present INPFC Convention the Japanese mothership fleet operates both within and outside the U.S. FCZ. The distribution of interceptions of North American salmon by area, maturity composition, and species are summarized in Tables 3, 4, and 5 for 1978, 1979, and 1980, respectively. Reported North American salmon catches appear in parentheses; however, as before, the more appropriate indicator of total impact is interceptions, i.e. catch plus dropout loss. As these tables indicate, for sockeye and chinook the composition of North American salmon interceptions are heavily weighted towards immature fish. This is particularly the case for interceptions inside the FCZ. The preponderance of immature fish in the Japanese take during this period is in stark contrast to pre-1978 interception patterns where a high proportion of the North American salmon intercepted were mature. In the case of North American sockeye, for example, from 1956 through 1977 the Japanese mothership fleet intercepted an average 76 percent maturing fish. Since the renegotiated INPFC agreement, the ratio of maturing to immature fish has been reversed, averaging over 78 percent immature North American sockeye during the three seasons. Because, as demonstrated above, maturing fish have a higher present value to domestic fisheries than do immature salmon, and because immature fish continue to undergo an estimated annual 10 percent natural mortality, this shift in Japanese interceptions away from maturing and to immature North American salmon has been a positive step for American interests.

Table 3

Interceptions* of North American Salmon by Japanese Mothership Fleet by Area, 1978
(Reported Catch Listed in Parentheses)

Area	Sockeye		Chinook		Chum	Total
	Maturing	Immatures	Maturing	Immatures	All Maturing	
All	165,416 (124,000)	472,000 (236,000)	4,135 (3,100)	55,800 (27,900)	10,672 (8,000)	708,023 (399,000)
Inside FCZ	22,678 (17,000)	446,000 (223,000)	2,535 (1,900)	34,200 (17,100)	0 (0)	505,413 (259,000)
Outside FCZ	142,738 (107,000)	26,000 (13,000)	1,600 (1,200)	21,600 (10,800)	10,672 (8,000)	202,610 (140,000)
South of FCZ	89,378 (67,000)	24,000 (12,000)	667 (500)	9,000 (4,500)	0 (0)	123,045 (84,000)
Bering Sea	53,360 (40,000)	2,000 (1,000)	933 (700)	12,600 (6,300)	10,672 (8,000)	79,565 (56,000)
W of 180°	50,025 (37,500)	1,000 (500)	266 (200)	3,600 (1,800)	6,670 (5,000)	61,561 (45,000)
E of 180°	3,335 (2,500)	1,000 (500)	667 (500)	9,000 (4,500)	4,002 (3,000)	18,004 (11,000)

* Interceptions reflect total number of fish killed, i.e. reported catch plus dropout loss.
Maturity for sockeye from Table 3, INPFC Bull. 30.
Maturity for chinook from INPFC Bull. 38, p. 43.

Source: Dr. Michael Dahlberg

Table 4

Interceptions* of North American Salmon by Japanese Mothership Fleet by Area, 1979
(Reported Catch Listed in Parentheses)

Area	Sockeye		Chinook		Chum	Total
	Maturing	Immatures	Maturing	Immatures	All Maturing	
All	90,665 68,000)	820,000 (410,000)	8,667 (6,500)	117,000 (58,500)	57,332 (43,000)	1,093,664 (586,000)
Inside FCZ	2,667 (2,000)	708,000 (354,000)	2,667 (2,000)	36,000 (18,000)	0 (0)	749,334 (376,000)
Outside FCZ	87,998 (66,000)	112,000 (56,000)	6,000 (4,500)	81,000 (40,500)	57,332 (43,000)	344,300 (210,000)
South of FCZ	87,998 (66,000)	2,000 (1,000)	134 (100)	1,800 (900)	0 (0)	91,932 (68,000)
Bering Sea	0 (0)	110,000 (55,000)	5,866 (4,400)	79,200 (39,600)	57,332 (43,000)	252,398 (142,600)
W of 180°	0 (0)	26,000 (13,000)	1,866 (1,400)	25,200 (12,600)	30,659 (23,000)	83,725 (50,000)
E of 180°	0 (0)	84,000 (42,000)	4,000 (3,000)	54,000 (27,000)	26,673 (20,000)	168,673 (92,000)

* Interceptions reflect total number of fish killed, i.e. reported catch plus dropout loss.
Maturity for sockeye from Table 3, INPFC Bull. 30.
Maturity for chinook from INPFC Bull. 38, p. 43.

Source: Dr. Michael Dahlberg

Table 5

Interceptions* of North American Salmon by Japanese Mothership Fleet by Area, 1980
(Reported Catch Listed in Parentheses)

Area	Sockeye		Chinook		Chum	Total
	Maturing	Immatures	Maturing	Immatures	All Maturing	
All	240,120 (180,000)	1,362,200 (681,100)	50,669 (38,000)	684,000 (342,000)	52,026 (39,000)	2,389,013 (1,280,100)
Inside FCZ	226,780 (170,000)	1,151,000 (575,500)	5,428 (4,070)	73,260 (36,630)	0 (0)	1,456,468 (786,200)
Outside FCZ	13,340 (10,000)	211,200 (105,600)	45,241 (33,930)	610,740 (305,370)	52,026 (39,000)	932,545 (493,900)
South of FCZ	13,340 (10,000)	0 (0)	120 (90)	1,620 (810)	0 (0)	15,080 (10,900)
Bering Sea	0 (0)	211,200 (105,600)	45,121 (33,840)	609,120 (304,560)	52,026 (39,000)	917,467 (483,000)
W of 180°	0 (0)	146,000 (73,000)	18,667 (14,000)	252,000 (126,000)	26,680 (20,000)	443,347 (233,000)
E of 180°	0 (0)	65,200 (32,600)	26,454 (19,840)	357,120 (178,560)	25,346 (19,000)	474,120 (250,000)

* Interceptions reflect total number of fish killed, i.e. reported catch plus dropout loss.
Maturity for sockeye from Table 3, INPFC Bull., 30.
Maturity for chinook from INPFC Bull. 38, p. 43.

Source: Dr. Michael Dahlberg

III. JAPAN'S RESPONSE TO A REVOCATION OF INPFC

As noted earlier, the preceding assessment of the impact of the Japanese mothership fishery has been predicated upon high immature to maturing interception ratios. As will be apparent in the following section concerning possible Japanese responses to the termination of INPFC, these maturity composition assumptions and their accompanying economic implications are vulnerable.

In reviewing feasible scenarios which might result from dissolution of the INPFC, the possibilty exists that the Japanese could resume an interception fishery targeting on stocks almost exclusively of North American origin and comprised of 70-75 percent maturing salmon. Obviously the United States retains other sources of leverage which could be applied to prevent this result. Access to U.S. groundfish stocks by the Japanese is one which readily comes to mind. But for purposes of examining Japanese reaction to the loss of INPFC, these have not been included.

Historically, the Japanese have fished as many as 16 motherships and 506 catcher vessels in the North Pacific high seas salmon fishery.[9/] As cited earlier, even as recently as 1976, this mothership fleet consisted of 10 factory vessels and

---

9/ Chitwood, P.E., *op cit*, p. 2.

332 catcher boats. Since 1978 when the INPFC was renegotiated the Japanese high seas drift gillnet fleet has consisted of 4 motherships and 172 catcher vessels.

Estimates of the probable impact on North American salmon resulting from the termination of the existing INPFC agreement are highly speculative. No accurate information is available regarding Japanese intentions or their likely response should the agreement be revoked. However, the following represent what is believed to be a reasonable "worst case analysis" based upon actual historic Japanese mothership CPUE data. Further, it is explicitly assumed that the total Japanese salmon catch in the North Pacific and Bering Sea will not be limited by any Japanese-Soviet salmon agreements, absent INPFC.

While no one can as yet accurately predict how many vessels would be available to the Japanese for deployment to this fishery absent the INPFC, three hypothetic scenarios have been evaluated to provide some perspective.

Very briefly, these include:

I. The present Japanese high seas mothership fleet divided into two equal subfleets, one operating in the northcentral Bering Sea,

outside the U.S. FCZ, and the other fishing south of the Aleutians, again just beyond the U.S. 200 mile limit.

II. The present Japanese high seas mothership fleet operating in the Gulf of Alaska and along the southeast Alaska panhandle westward of the U.S. FCZ boundry.

III. An effective doubling of the present Japanese mothership harvesting capacity fishing all of the waters described under the previous two scenarios.

One Course of Action

As noted, the first scenario assumes the present 4 factory ships and 172 catchers, divided equally into two subfleets. It is further assumed that these subfleets will fish a 60-day season, from June 1 through July 31. CPUE will remain at historic levels (based on records from 1956 to 1980). Two motherships and eighty-six catchers (each fishing 330 tans) operate in the Bering Sea outside the FCZ. The other 2 factory ships and 86 catchers are assumed to operate south of the U.S. FCZ and west of 160°W (Figure 3). Table 6 summarizes the resultant impact on North American salmon stocks and the associated loss in exvessel gross earnings to

domestic salmon fisheries. As before, while "catch" figures are presented, the more appropriate measure of the impact on North American salmon is the "interception" figure.

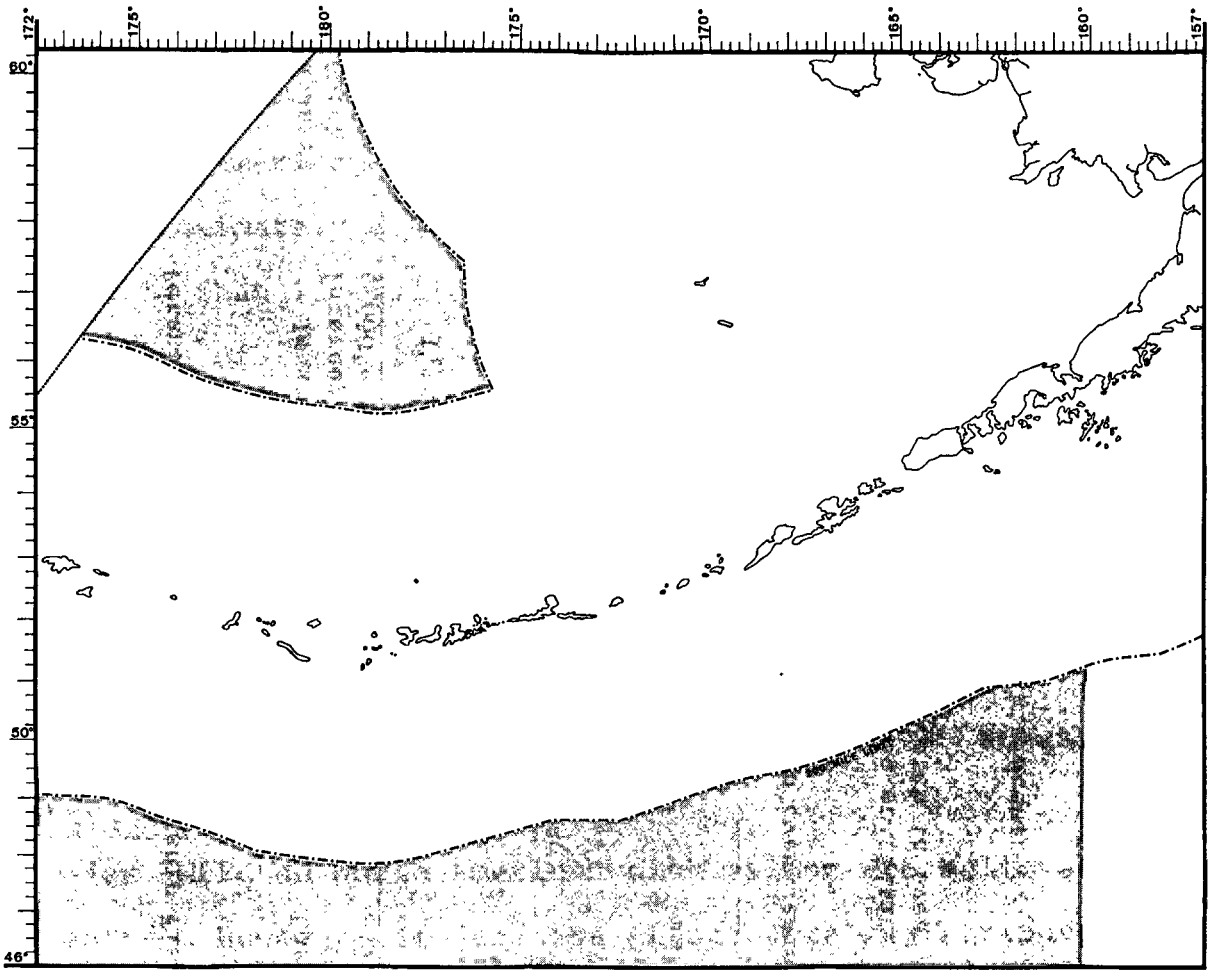


Figure 3. Japanese High Seas Salmon Activity Under Scenario One.

Similarly, while loss in exvessel gross revenues are presented, the appropriate measure of economic loss at this level of the domestic fishery is the discounted present value of the potential income stream foregone. No measure of the total domestic economic impact is made owing to limitations on data. However,

Table 6

Potential Impact of Japanese Mothership Fishery
Under Scenario One

	Japanese Catch (1000's fish)	Japanese Interceptions (1000's fish)	Loss to U.S. Salmon Fisheries (1000's fish)	Loss U.S. Exvessel Gross Revenues (1000's dollars)	Discounted Present Value (1000's dollars)
Chinook	600.0	1,159.0	958.0	22,992.5	21,829.8
Sockeye	8,771.5	13,330.4	12,838.6	66,804.9	66,148.6
Chums	250.0	333.3	333.3	1,283.0	1,283.0
Pinks 1/	505.0	673.2	673.2	777.5	777.5
Total 2/, 3/	10,126.5	15,495.9	14,803.1	91,857.9	90,038.9

1/ North American pinks are present in this fishery only in even years; assumes no North American pinks intercepted in odd years.

2/ Totals reflect average annual impacts, i.e. pink salmon statistics which accrue only in even years have been averaged over all years, e.g. total catch in even years would be 10,379,000; odd years 9,874,000.

3/ North American coho's are assumed not present in this scenario.

they would undoubtedly be substantial. Once again, real prices were asssumed constant over the period of the analysis and a 3 percent real annual discount rate was employed.

Under scenario one (Table 6), the Japanese mothership take of North American salmon would increase from the 1980 high of approximately 2.4 million interceptions/1.3 million catch to more than 15 million interceptions/10 million catch. The majority of these fish would be Bristol Bay sockeye and, unlike the catch composition under INPFC of roughly 20 percent maturing, the hypothetical fishery would take approximately 73 percent maturing fish, just as they moved toward the domestic Bristol Bay fisheries. As a result, the economic impact on U.S. salmon fisheries would rise from its 1980 level of $21.5 million[10/] to more than $90 million[10/] annually.

Under INPFC no North American pink salmon are believed intercepted. However, if Japanese effort were redistributed as described above, 673,200 North American pinks would be intercepted by the high seas fleet. Because of the cyclical nature of these stocks, this loss of North American pinks would occur only in even numbered years. In order to reflect the "total average loss" of North American salmon (Table 6) the interceptions of pinks have been distributed equally over odd and even years, although maximums and minimums are footnoted.

10/ Discounted present value.

As with the present INPFC restrictions, all the North American salmon taken under this operational scenario would be of western Alaska origin. The exvessel economic impact would, therefore, be imposed upon the commercial fishermen operating in this region. In 1979 western Alaska commercial salmon driftnet fishermen numbered 1,610, the setnet fishermen 2,470, and fishwheel operators 124. In 1980 there were 1,690 active driftnetters, 2,488 setnetters, and 124 fishwheel operators, with an estimated total exvessel gross earnings from salmon of $134.4 million.[11/]

A Second Course of Action

Under scenario two, the 4 mothership, 172 catcher boat fleet fishing 330 tans/catcher is assumed to operate in the Gulf of Alaska, east of 160°W and north of 46°N outside the FCZ (Figure 4). They are further assumed to fish a 60-day season from June 1 through July 31. Unlike scenario one and the present INPFC regulated fishery, under this set of assumptions the Japanese would fish upon stocks of southeast Alaskan, Canadian, and U.S. Pacific Northwestern origin (Table 7). As before, the relevant measures of impact are "interceptions" and "discounted present value." For the first time North American cohos are present in significant numbers among the Japanese interceptions and the chinook taken are of higher

---

11/ Personal communication, Elaine Dinneford, Alaska Commercial Fisheries Entry Commission. (1982)

exvessel value than their counterparts in western Alaska. The exvessel prices used in the analysis of scenario two are chinook $2.00/lb., sockeye $.85/lb., chums $.55/lb., pinks $.35/lb. and coho's $1.20/lb. Once again, pinks are present in significant numbers only during even years, but for purposes of estimating the "average" annual impact the even year figures have been divided equally between even and odd years.

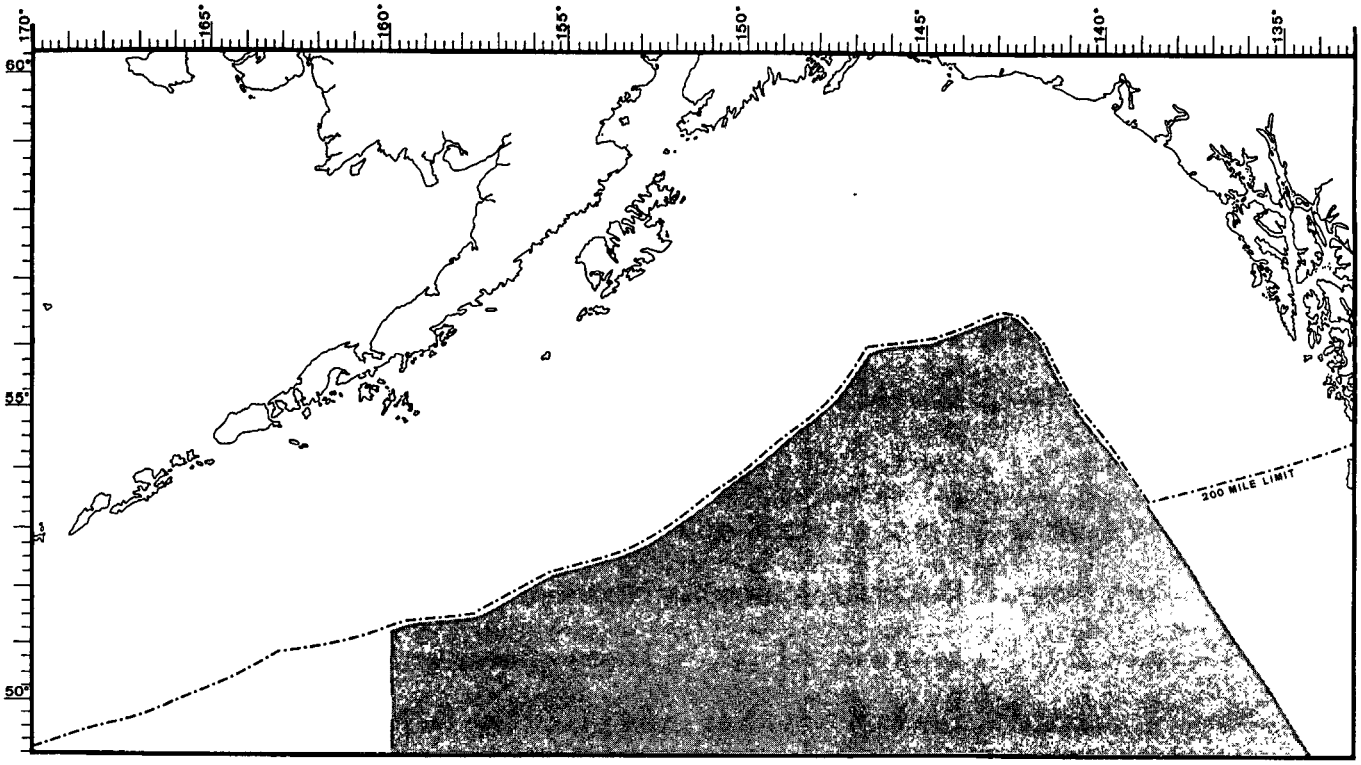


Figure 4. Japanese High Seas Salmon Activity Under Scenario Two.

Table 7

Potential Impact of Japanese Mothership Fishery
Under Scenario Two

	Japanese Catch (1000's fish)	Japanese Interceptions (1000's fish)	Loss to U.S. Salmon Fisheries (1000's fish)	Loss U.S. Exvessel Gross Revenues (1000's dollars)	Discounted Present Value (1000's dollars)
Chinook	60.0	115.9	95.0	4,598.5	4,365.9
Sockeye	1,016.0	1,964.2	1,781.4	9,084.9	8,840.4
Chums	1,900.0	3,483.2	3,069.9	11,819.2	11,420.3
Pinks 1/	7,345.0	9,790.9	9,790.9	11,308.5	11,308.5
Cohos	633.0	843.8	843.8	7,847.2	7,847.2
Total 2/	7,281.5	11,302.6	10,686.3	39,004.1	38,128.1

1/ North American pinks are present in this fishery only in even years; assumes no North American pinks intercepted in odd years.

2/ Totals reflect average annual impacts, i.e. pink salmon statistics which accrue only in even years have been averaged over all years, e.g. total catch in even years would be 10,954,000; odd years 3,609,000.

Species composition based upon purse seine sampling in Gulf of Alaska from 1961-68.

Under this set of assumptions the composition of the interception by the Japanese high seas mothership fleet reflects the higher concentrations of pinks and chums in this area. Because of the cyclical nature of the pink salmon runs, Japanese catch in this area would be expected to vary dramatically from even to odd years, i.e. 10,954,000 to 3,609,000 fish, respectively. For the first time the exvessel economic burden associated with the Japanese mothership fishery would be borne by southeast Alaskan, Canadian, Oregon, Washington, and California commercial fishermen. This loss could average more than $38 million per year, at the exvessel level alone, compared to the $21.5 million exvessel impact of the 1980 mothership interceptions, or the 1975-80 average exvessel impact of just over $11.8 million.12/

This scenario also contains the potential for significant political and cultural impacts. In particular, the interception by the Japanese of nearly 116,000 chinook salmon each year could seriously threaten the existence of some west coast wild stocks and severely impact United States and Canadian fisheries management. It is probable that significant numbers of Columbia River upriver bright chinook salmon would be among those salmon taken by the Japanese. This particular run is already threatened and continues to be the

---

12/ These figures reflect discounted present value at the exvessel level.

focus of litigation between Indian and non-Indian fishermen. The loss of these fish to Japanese gillnetters would serve only to aggravate this already conflict-charged situation.

Similarly, the United States and Canada have sought to resolve the problem of salmon interceptions which occur between the two nations through bilateral negotiations and cooperative management efforts. Progress towards a comprehensive solution to the U.S./Canada salmon interception problem has been slow, but appears to be approaching a resolution. The loss of more than 11 million west coast salmon annually to Japanese offshore nets could effectively nullify this progress and, at a minimum, threaten any chance of resolving the U.S./Canadian salmon management dilemma.

A "Worst Case" Possibility

A third, and in a sense, worst case scenario can be reasonably identified in response to a dissolution of the INPFC. It would essentially involve the Japanese mothership fishery undertaking both scenarios one and two simultaneously. As noted above, the Japanese have historically operated as many as 16 factory vessels in this fishery. Scenario three would require a total of 8 motherships and 352 catchers working a 60-day June 1 through July 31 season, annually. The result of such an operational configuration by the Japanese could

be approximated by summing the total impact of scenarios one and two. This is appropriate because in each hypothetical case the Japanese high seas fishery would exploit distinctly different North American stocks. This procedure yields an average total annual catch of North American salmon by the Japanese mothership fleet in excess of 17,400,000 fish; an interception, or kill, of 26,798,500 fish, with an average discounted exvessel value to domestic fishermen of $128,167,000, annually.

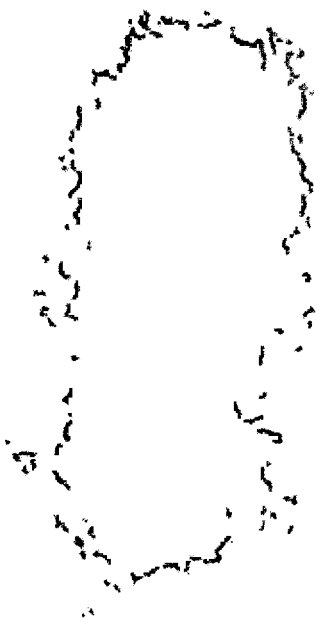
It is important to emphasize once again that the entire preceding analysis evaluates domestic losses only at the exvessel level. Significant additional losses could be traced out for each level of the domestic salmon industry as a result of the Japanese pursuing any of the above alternative fishing strategies in the absence of INPFC.

IV. SUMMARY AND CONCLUSIONS

In summary, under the existing INPFC Protocol negotiated in 1977-78 the Japanese high seas mothership salmon fishery has been limited geographically and temporally in an effort to accommodate the interests of all three signatories. Even within these constraints, however, Japanese high seas gillnet activity inflicts a significant annual exvessel impact on U.S. fisheries through interceptions of North American stocks. In 1980 this loss exceeded $21.4 million in discounted exvessel value. Since 1978 the annual loss has averaged about $11.8 million. This burden is effectively limited to western Alaska fisheries.

Should the INPFC be dissolved and the Japanese be excluded from fishing for salmon in the U.S. FCZ, there are several possible courses the mothership fishery might take. Once freed of its obligations under INPFC, the Japanese could operate just outside of the U.S. FCZ, legally within international waters, and capture substantially greater numbers of North American salmon than is presently the case under INPFC. In fact, in what is judged to be a reasonable "worst case scenario" resulting from the termination of INPFC, and based upon historic Japanese CPUE data, the average total annual interception of North American salmon by the Japanese mothership fleet could exceed 26,798,000 fish, with an

average annual real discounted exvessel value to domestic fishermen of $128.2 million. The actual loss to the United States (and Canada) could be substantially greater. Induced impacts would necessarily reach virtually every level of the commercial salmon industry and disrupt fishery dependent coastal communities along the entire North American west coast.



ACKNOWLEDGEMENT

The author wishes to acknowledge the contributions made to this analysis by the following NMFS statisticians. Dr. Joseph Terry, Messrs. Robert Simpson and Richard Major, NWAFC; Dr. Michael Dahlberg, Auke Bay Laboratory; and Messrs. Philip Chitwood, Ronald Naab, William Robinson, and Mrs. Janet Smoker, Alaska Region.

The report was adeptly arranged and typed by Mrs. G. Christine Stone.