AGENDA D-4
MARCH 1985

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Jim H. Branson
Executive Director

DATE: March 21, 1985

SUBJECT: Bering Sea/Aleutian Islands FMP

ACTION REQUIRED

Approve amendment package and decision documents for public review.

BACKGROUND

Prior to 1984 the Council accepted FMP amendment proposals during the entire year. In April 1984 the Council adopted annual management cycles for each FMP, accepting proposals for amendments only once a year. The Gulf of Alaska and Bering Sea/Aleutian Islands Groundfish FMPs share the same schedule. In September 1984 the Council requested proposals for managing the BSAI groundfish fisheries and set the deadline for proposals at December 7, 1984. The Plan Team reviewed and ranked each proposal and at the February meeting the Council reviewed the recommendations of the Plan Team, the SSC and AP. Six proposals were selected for inclusion in Amendment 10 and others were identified for analysis and consideration in the 1986 management cycle.

Initial Council review of the Amendment 10 package and approval for public review are scheduled for this meeting. Item D-4(a) is a summary of the issues and alternatives addressed in the EA and draft RIR/RFA. Item D-4(b) is the amendment package including the EA and draft RIR/RFA.

BERING SEA/ALEUTIAN ISLANDS GROUNDFISH FISHERY MANAGEMENT PLAN

AMENDMENT 10

March 1985

The North Pacific Fishery Management Council has directed the Bering Sea Plan Team to prepare an amendment (No. 10) and supporting documentation for management of the Bering Sea/Aleutian Islands groundfish fisheries. The Council has identified the issues and problems to be addressed by Amendment 10 but has not yet chosen preferred solutions. The Plan Team has reviewed the issues and identified and analyzed the biological, socioeconomic and management impacts of various alternative solutions for public and Council consideration. These issues and alternative solutions are listed and briefly described below. A draft Environmental Assessment (EA), and Initial Regulatory Impact Review/Regulatory Flexibility Analysis (RIR/RFA) will be reviewed by the Council at their March 27-28 meeting and will be approved for public review. Public comment on these documents and issues will be accepted for approximately 30 days. At their May meeting the Council will make their final decision and submit the amendment and supporting documentation to the Secretary of Commerce for implementation.

This statement of issues and possible solutions as well as the EA and RIR/RFA are intended to provide information to the fishing community so they can provide meaningful testimony to the Council in their deliberations. Any comments or data which might affect the biological or socioeconomic analyses in the EA and RIR should be submitted to the Council in written form during the 30-day comment period. Although the Council will accept oral testimony at the May meeting, such testimony should be limited to clarification of earlier written comments rather than submission of new information.

ISSUES AND ALTERNATIVE MANAGEMENT SOLUTIONS

A. Raise the upper end of the Optimum Yield (OY) range.

Japan Fisheries Association has proposed raising the upper end of the OY range. This would provide greater management flexibility to respond to years of high stock abundance and would allow the annual Total Allowable Catch (TAC) be increased above the current ceiling.

Alternative 1. Raise the upper OY to 2.5 million mt.

The proposed upper limit is somewhat arbitrary in that it is above the Maximum Sustained Yield (MSY) ceiling of 2.4 million mt.

Alternative 2. Status quo.

The annual catch has exceeded the current OY ceiling only twice (both times prior to FMP implementation). Since that time the sum of the EYs has exceeded the ceiling in 1983, 1984, and 1985 and catches have had to be constrained. This situation may re-occur in the future.

B. Reduce the incidental catch of salmon in joint venture fisheries.

In 1983, the first year of significant joint venture pollock harvest north of the Aleutians in INPFC Area I, the joint venture incidental catch included 24,493 (mostly chum) salmon. In 1984 the incidental catch was 60,436 salmon, again mostly chums. In both years the catch was concentrated in a roughly 2°x5° area during July and August and were taken almost entirely with mid-water gear. Joint ventures harvested 55,000 to 96,000 mt of groundfish valued at $5 to $9 million in this area during this period.

The Western Alaska traditional salmon fisheries fully utilize this resource and the FMP states that trawlers must minimize their bycatch of salmon. Currently there is no information on the origin of these salmon or how long they remain in this area.

Alternative 1. Close the area from 55°N to 56°30'N between 164°W and 169°W from July 20-August 25.

The majority of the incidental salmon catch was taken in this time-area in 1983 and 1984.

Alternative 2. Close the area from 55°-56°30'N between 164°-169°W from July 20-August 25 when a salmon prohibited species catch limit is reached.

This closure would be implemented only if the salmon bycatch exceeds a certain level.

Alternative 3. Impose incidental catch quotas for individual joint ventures.

Alternative 4. Impose incidental catch fees.

Alternative 5. Status quo.

Current regulations require trawlers to release all salmon but do not restrict the number of salmon actually caught. Voluntary measures could be recommended.

C. Reduce the incidental catch of fully utilized domestic species by foreign trawlers.

The rapid expansion of U.S. fishing and processing capacities has led to full utilization of several groundfish species in Alaskan waters. Measures to reduce or eliminate bycatch of these species by foreign fisheries will allow domestic fishermen to capitalize on the resource more effectively.

Alternative 1. Close the area within 20 miles of the Aleutians to all foreign trawling.

The Council voted to enact an emergency regulation to close this area to reduce the incidental catch of Pacific cod, Atka mackerel, sablefish, and Pacific ocean perch. This closure would have reduced the 1983 foreign bycatch of these species from 88-92% but would have reduced the all-species harvest by 64%.

Alternative 2. Status quo.

Although no data are available yet for definitive analysis, indications are that most foreign fishing in 1984 occurred outside the proposed 20 mile closure. This was due to the greatly reduced allocations of these fully utilized species.

Alternative 3. Impose catch fees on the foreign trawl fleet.

D. Require domestic catcher/processors to submit periodic catch reports.

Because catcher/processors often remain at sea for several months at a time, it is virtually impossible for management agencies to track cumulative catches on a timely basis and to accurately predict the attainment of DAP levels in the fishery.

Alternative 1. Status quo.

The number of catcher/processor vessels and subsequent catches are expected to substantially increase in 1985. Without periodic reporting it is likely that TACs will be exceeded in the future leading to potential resource damage.

Alternative 2. Require an FCZ processing permit with check-in/check-out and weekly catch report.

Alternative 3. Require an FCZ processing permit with a weekly catch report, but without check-in/check-out requirements.

Alternative 4. Place observers aboard a small sample of catcher/processor and mothership/processor vessels and extrapolate the catch from these vessels to the entire fleet.

Alternative 5. Place observers aboard all catcher/processor and mothership/processor vessels.

E. Reduce the groundfish complex reserves.

Currently 15% of the total groundfish TAC is withheld at the beginning of the year to cover catch adjustments due to errors in either stock status evaluations or estimates of DAH. Japan Fisheries Association (JFA) has requested that the reserve be decreased in order to provide foreign fisheries more certainty as to the availability of resource surpluses from the beginning of the year.

Alternative 1. Decrease the groundfish complex reserve to 10%.

This is the JFA proposal and would address their concerns.

Alternative 2. Status quo.

The current (15%) reserve has not proved limiting to domestic fisheries, although it may be more conservative than necessary.

F. Implement the NMFS Habitat Policy.

This proposed action modifies and adds certain sections specifically to address habitat requirements of individual species. It also provides the necessary authorization for implementation of marine debris restrictions and other regulations to protect the marine habitat.

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ENVIRONMENTAL ASSESSMENT OF AMENDMENT 10
TO THE FISHERY MANAGEMENT PLAN FOR THE
GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

ADOPTED BY
THE NORTH PACIFIC FISHERY MANAGMENT COUNCIL
FOR PUBLIC REVIEW

PREPARED BY THE PLAN TEAM FOR THE
GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

MARCH 1985

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ENVIRONMENTAL ASSESSMENT OF AMENDMENT 10

TO THE FISHERY MANAGEMENT PLAN FOR THE

GROUNDFISH FISHERY OF THE BERING SEA AND ALEUTIAN ISLANDS AREA

I. INTRODUCTION

The domestic and foreign groundfish fishery in the 3-200 mile fishery conservation zone of the eastern Bering Sea is managed under the Fishery Management Plan for the Groundfish Fishery of the Bering Sea and Aleutians Islands Area (FMP). This FMP was developed by the North Pacific Fishery Management Council (Council), approved by the Assistant Administrator for Fisheries, NOAA (Assistant Administrator), and implemented by a final rule on January 1, 1982 (46 FR 63295, December 31, 1981). A final environmental impact statement was prepared for the FMP and is on file with the Environmental Protection Agency. Since that time, the Council has adopted nine amemdments to the FMP. The subject of this action is DRAFT amendment 10. It contains six proposals, which are described below.

Prior to 1984, the Council would receive amendment proposals during any of its scheduled meetings. At its April, 1984 meeting, the Council adopted a policy whereby proposals for amendments would be received only once a year. Proposals contained in Amendment 10 were requested by the Council in September 1984 with a deadline set at December 7, 1984. The Council then instructed its Plan Team to review and rank each proposal that was received. At its February 1985 meeting, the Council reviewed the recommendations of the Plan Team, Scientific and Statistical Committee, and Advisory Panel, and selected six proposals for inclusion in Amendment 10. Other proposals were identified for development and consideration in a future amendment.

The six topics to be reviewed in this environmental assessment are: (1) increase the upper end of the optimum yield (OY) range to 2.5 million metric tons; (2) Reduce the incidental catch of chum salmon (Onchorhynchus keta) by joint venture trawlers. (3) Establish measures to reduce the incidental bycatch of fully utilized domestic species by foreign trawlers in the Aleutian Islands. (4) establish a reporting system for catcher/processor vessels; (5)

Reduce the specified groundfish reserve from 15 percent to 10 percent of the annual optimum yield. and (6) implementation of NMFS habitat policy. Each of these topics will be presented as chapters of this document.

This environmental assessment is prepared under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and its implementing regulations.

II. DESCRIPTION OF AND THE NEED FOR THE MANAGEMENT MEASURES

1. INCREASE THE UPPER END OF THE OPTIMUM YIELD RANGE TO 2.5 MILLION MT

The objective of this proposal is to provide for greater management flexibility necessary to more fully utilize groundfish resources in amounts consistent with increases in biomass surplus production. Amendment 1 to the FMP established a single optimum yield (OY) for the groundfish complex in the Bering Sea/Aleutians equal to a range of 1.4 - 2.0 million mt. The complex has 10 commercial species or species groups of groundfish. The OY is equal to the sum of the Total Allowable Catch (TAC) for each species. Each year the Council determines the TAC for each species using the best available information concerning the acceptable biological catch or equilibrium yield (EY) for each species and also socioeconomic data. The sum of the TACs cannot exceed or be less than the OY without amending the FMP, a process that requires about one year.

The maximum sustainable yield for the groundfish complex is estimated to be 1.7-2.4 million mt. This amount is equal to the sum of the MSYs for the major individual species groups. Ecosystem models, however, indicate that the MSY may exceed 2.4 million mt. These models simulate the dynamics of the principal components of the Bering Sea/Aleutian ecosystem and indicate that the minimum exploitable groundfish biomass may be at least 9.5 million mt. This amount should be capable of sustaining exploition above 25 percent or more than 2.4 million mt.

When Amendment 1 was developed and implemented, the sum of EYs was below the upper end of the OY range. Recruitment of several strong year classes of groundfish have enhanced the condition of several stocks, which have thus increased in biomass. As a result EYs have increased steadily from 1.5 million mt in 1977 to a peak of 2.2 million mt in 1984. The current upper limit on the OY has constrained the Council during some years from setting a total TAC at a level that would allow for fuller utilization of surplus production. This constraint has occurred during the last three years - 1983, 1984, and 1985 when the EY exceeded 2.0 million mt for each year (Table 1). Although the sum of EYs has declined slightly in 1985 and certain other factors indicate that the sum of EYs may decline in the near future, the sum of EYs is expected to exceed 2.0 million mt in future years as a result of conservation and management measures now made possible under the Magnuson Act. An increase in the upper end of the OY range would provide the Council and the Secretary of Commerce broader latitude to fully utilize the groundfish resources.

Table 1. Estimated MSY and EY (1,000s mt) for the groundfish complex in the Bering Sea/Aleutian Islands Area.

Year	MSY*	EY	OY
1977	1,627-2,251	1,486	1,368
1978	1,627-2,251	1,485	1,486
1979	1,627-2,251	1,571	1,486
1980	1,627-2,251	1,791	1,571
1981	1,630-2,307	1,910	1,579
1982	1,677-2,351	1,928	1,579
1983	1,676-2,223	2,127	1,624
1984	2,086-2,212	2,248	2,000
1985	2,095-2,220	2,188	2,000

* Note: Total annual MSYs fluctuate from year to year within the FMP range of 1.7-2.4 million mt to reflect new information obtained about the conditions of various groundfish species.

2. REDUCE THE INCIDENTAL CATCH OF CHUM SALMON (Onchorhynchus keta) BY JOINT VENTURE TRAWLERS

U.S. joint venture operations, i.e. U.S. fishing vessels delivering their catch to foreign processing vessels, have expanded dramatically in the Bering Sea and Aleutian Islands since their introduction to the area in 1980 (Table 2). The total all species harvest increased by more than ten-fold from 1980 to 1984 and is expected to nearly double again in 1985. The majority of this increase has been in pollock joint ventures in the Bering Sea, which increased from 10,600 mt in 1980 to 149,000 mt in 1983. Preliminary data indicate the harvest reached over 235,000 mt in 1984, and in 1985 it is expected to reach over 390,000 mt.

This rapid development of the U.S. fishing industry, while very profitable to those involved, has led to increased catches of species which are prohibited to both foreign and domestic trawl vessels. The FMP and current groundfish regulations state that "The operator of each vessel shall minimize its catch of prohibited species." All species of salmonids, including chum salmon, are considered prohibited species and must be returned to the sea with a minimum of injury. Foreign nations are given a salmon prohibited species catch (PSC) limit which equals the total salmon PSC multiplied by the ratio of the nation's groundfish allocation divided by the total TALFF plus reserves. Once the nation's PSC limit is reached, the Salmon Savings Area is closed to trawling by that nation for so much of January - March and October - December that remains in the fishing year. Any subsequent salmon catch during the year is deducted from the nation's limit for the next year. An incidental catch reduction schedule has been in effect since 1982, effectively reducing the number of salmon caught each year.

Due to the short time domestic vessels have operated in the Bering Sea/Aleutian Islands management area, no such catch restrictions or penalties have been implemented for U.S. trawl vessels. In 1983 an increase in joint venture agreements between U.S. catcher vessels and Japanese processing vessels led to a nearly tripling of the U.S. pollock catch in the Bering Sea. At the same time, the U.S. catch of salmon increased from 2,382 in 1982 to

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Table 2.--Estimated catches of groundfish (1,100s t) taken by the foreign and joint-venture fisheries in the Bering Sea/Aleutian region 1977-84.[a]

Fisheries/ species group	1977	1978	1979	1980	1981	1982	1983	1984[b]
FOREIGN DIRECTED FISHERY								
TOTAL	1,288.7	1,383.3	1,288.3	1,295.0	1,273.0	1,188.1	1,125.2	1,193.1
Pollock	978.4	977.7	944.0	1,006.1	986.9	959.9	891.5	
Pacific cod	35.9	46.8	41.4	37.3	39.1	28.2	41.5	
Sablefish	4.6	2.0	2.2	2.4	3.0	3.8	3.2	
Atka mackerel	NA	24.2	23.3	20.2	18.0	7.4	1.2	
Rockfish	10.8	7.5	7.2	8.5	7.3	4.9	2.0	
Yellowfin sole	47.3	140.9	101.1	77.8	81.2	76.0	85.9	
Turbots and other flatfishes	89.3	94.9	89.9	88.5	91.9	79.3	80.3	
Pacific herring	19.3	8.4	7.5	0.8	0.3	1.9	1.4	
Other fish	94.7	71.5	64.7	47.0	39.4	22.3	14.3	
Squid	8.4	9.4	7.0	6.4	5.9	5.0	4.0	
JOINT-VENTURE FISHERY								
TOTAL				32.7	78.5	108.6	211.2	361.8
Pollock				10.6	42.1	54.6	149.0	
Pacific cod				8.4	9.2	13.6	14.4	
Sablefish				<0.1	0.2	0.1	0.1	
Atka mackerel				0.3	1.6	12.5	10.5	
Rockfish				0.1	<0.1	<0.1	0.1	
Yellowfin sole				9.6	16.0	17.4	22.5	
Turbots and other flatfishes				2.8	6.0	9.2	11.7	
Pacific herring				0.1	0.0	<0.1	1.1	
Other fish				0.7	3.4	1.1	1.6	
Squid				0.0	<0.1	<0.1	<0.1	

[a] Statistics for 1977-83 from Berger et al, 1984
[b] Preliminary

24,493 salmon in 1983 (Table 3). In 1984, joint ventures took a total of approximately 60,400 salmon, 99.9% of which were chum (Table 4).

This high salmon bycatch by joint ventures has been concentrated in a relatively short time period and small area. For example, in 1983 high catch rates began on July 31, peaked on August 16 and were over by August 25 (Figure 1). While this figure reflects only hauls where 50 or more salmon were captured, it is indicative of all catches in this time and area. Table 5 shows the monthly summaries of salmon catch and the corresponding groundfish catches in INPFC statistical areas 1,2, and 4. These data are also shown by location in Figure 2. High salmon bycatches occurred between 54°30'N and 56°N and between 164°W and 169°W in 1984.

Foreign trawlers have been generally successful in avoiding concentrations of salmon in recent years, although Japanese surimi trawlers targeting on pollock did encounter numbers of chum salmon. Figure 3 shows their fishing patterns throughout 1983 and the associated salmon bycatch rates. In the third quarter bycatch rates approached 0.5 salmon per metric ton of groundfish in the area of concern. Joint venture bycatch patterns for the same period (Figure 4) are generally similar but significantly higher in two ½° x 1° statistical reporting areas.

The time and location of catch make determination of the origin of these chum salmon very difficult. Although scale samples were taken from many of these salmon, the scales have not been analyzed to determine stock origin. Preliminary indications are that the fish were immature and not destined to spawn until at least the next year. They were not schooled up as part of a spawning run and in fact were caught after spawning chum salmon had entered western Alaska rivers. Present knowledge of chum salmon migration patterns is sketchy although they are known to migrate great distances. Stock separation studies based on scale pattern analysis and high seas tagging indicate that maturing chum salmon caught in June in the same general area are destined to spawn in Bristol Bay rivers, the Yukon River, other western Alaska rivers, Japan and the Soviet Union. Most fish in the area (roughly 80-95%) were Alaskan fish. No information is available on chum salmon in the time and area of concern. However, it is reasonable to assume that a large portion of these

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Table 3.--Estimated incidental catches (Nos. and t) of salmon (Oncorhynchus spp.) in the foreign and joint-venture groundfish fishery in the Bering Sea/Aleutian Island region, 1977-84.

Year	Total		Foreign		Joint-venture	
	(Nos.)	(t)	(Nos.)	(t)	(Nos.)	(t)
1977	47,840	198	47,840	198	NF	NF
1978	44,548	137	44,548	137	NF	NF
1979	107,706	340	107,706	340	NF	NF
1980	122,002	388	120,104	381	1,898	7
1981	43,191	140	42,337	137	854	3
1982	23,623	92	21,241	85	2,382	8
1983	42,666	120	18,173	66	24,493	54
1984 (Jan.-Nov.)	73,200		12,800		60,573	

NF = no fishing

More than 97 percent of salmon in joint-venture fisheries were chum salmon in 1983 and 1984.

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Table 4.--Estimated incidental catches (Nos. and t) of chum salmon (*Oncorhynchus keta*) in the foreign and joint-venture groundfish fishery in the Bering Sea/Aleutian Island regon, 1977-84.

Year	Total			Foreign			Joint-venture		
	(Nos.)	%	(t)	(Nos.)	%	(t)	(Nos.)	%	(t)
1977	4,306	9		4,306	9		NF		
1978	4,811	10.8		4,811	10.8		NF		
1979	6,139	5.7		6,139	5.7		NF		
1980	6,726	5.6		6,726	5.6		0	0	0
1981	6,184	14.32	18.12	5,800	13.7	17.02	384	45.0	1.10
1982	7,697	32.58	25.30	7,116	33.5	23.91	581	24.4	1.39
1983	32,141	75.33	75.14	8,201	45.09	22.47	23,940	97.74	52.67
1984[a]	73,200			12,800			60,400		

[a] Preliminary through November 1984.
NF = no fishing.

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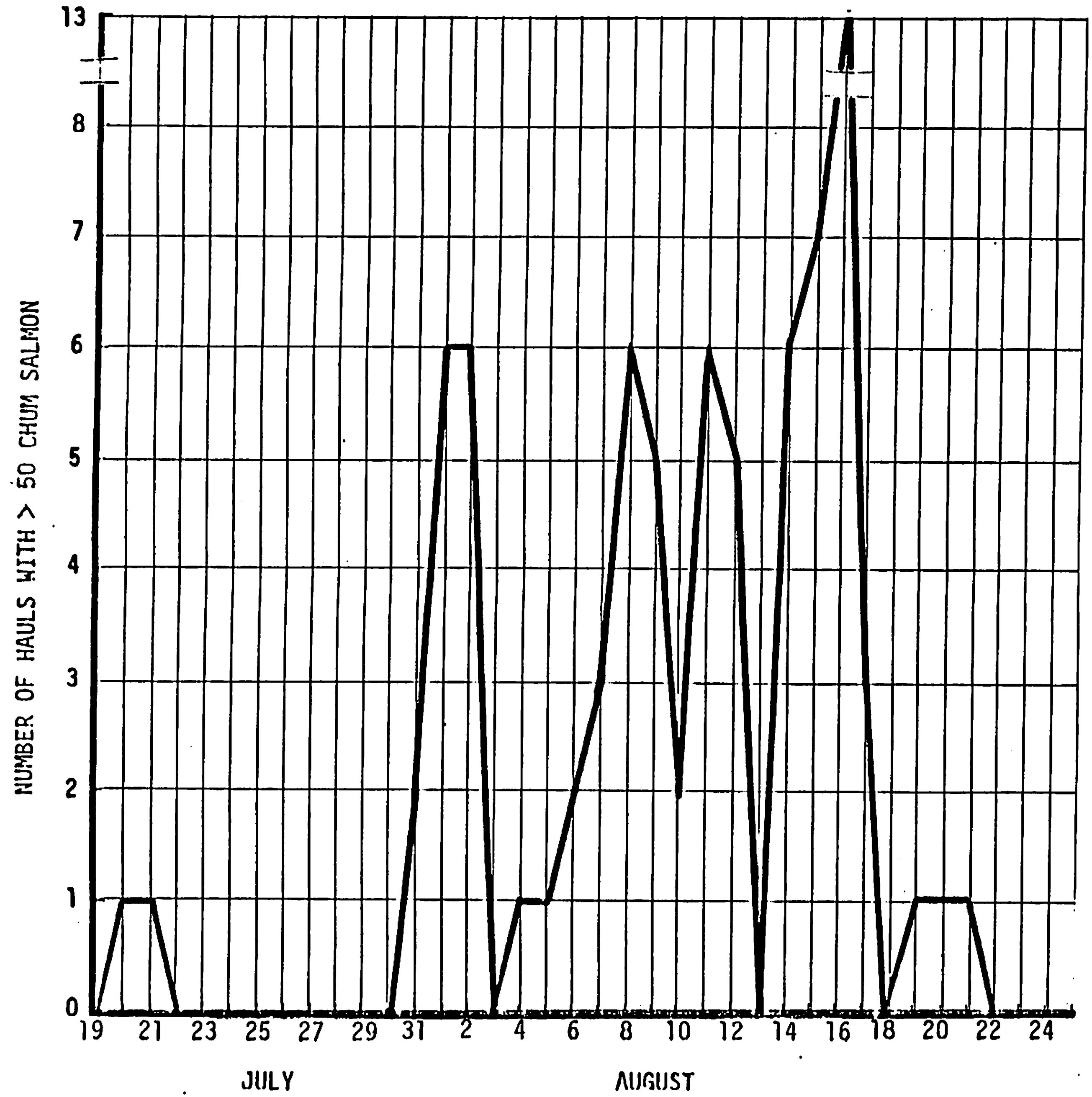

Figure 1 Number of hauls with greater than 50 chum salmon by daily periods, July-August 1984.

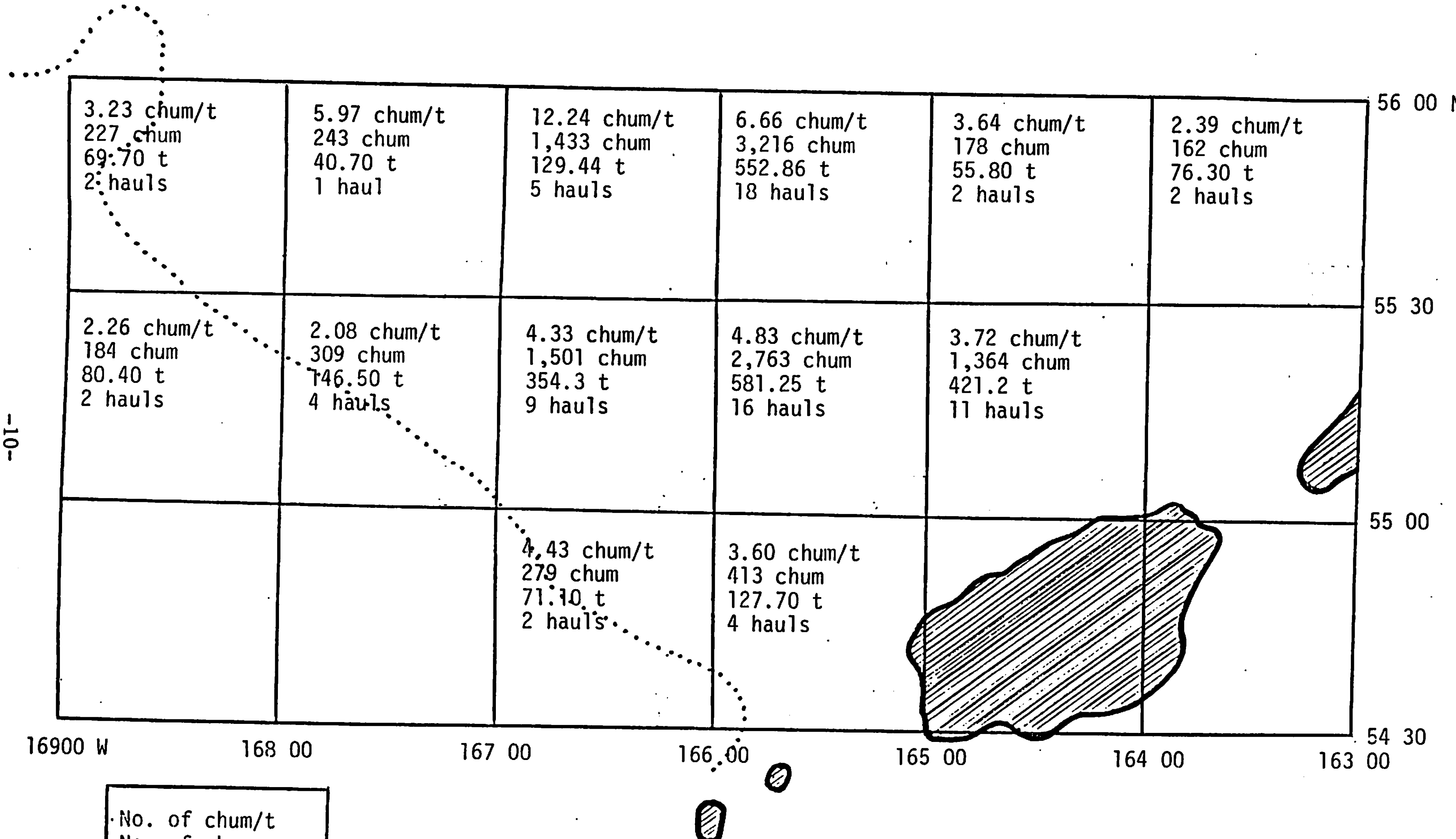

Figure 2. Catch rate and amount of chum salmon in joint-venture fisheries by statistical blocks, July-August 1984. Only hauls wiht greater 50 chum salmon were included.

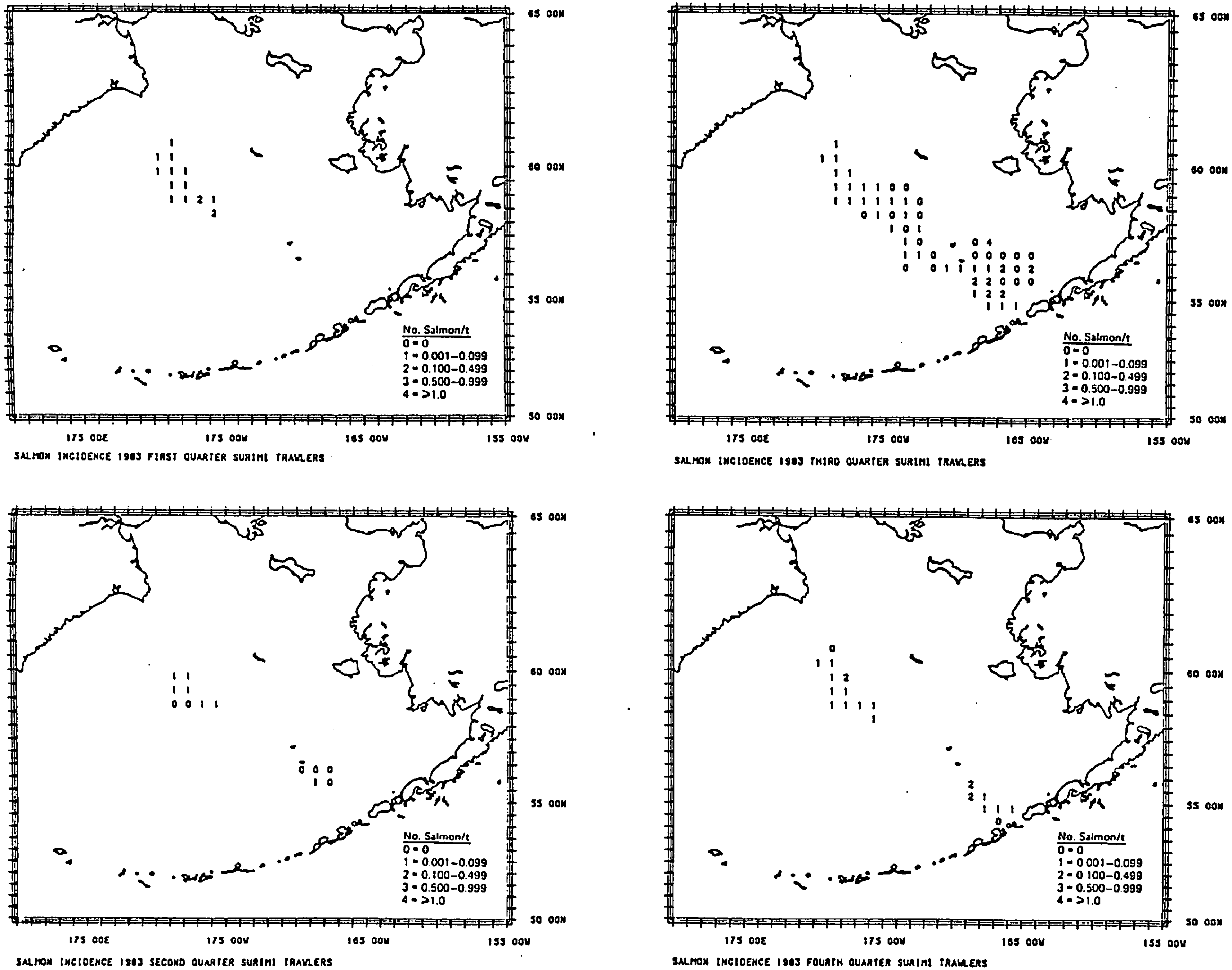

Figure 3.--Average incidence (no./t) of salmon on surimi trawlers (all nations) by quarter and 1/2° lat. by 1° long. areas, 1983.

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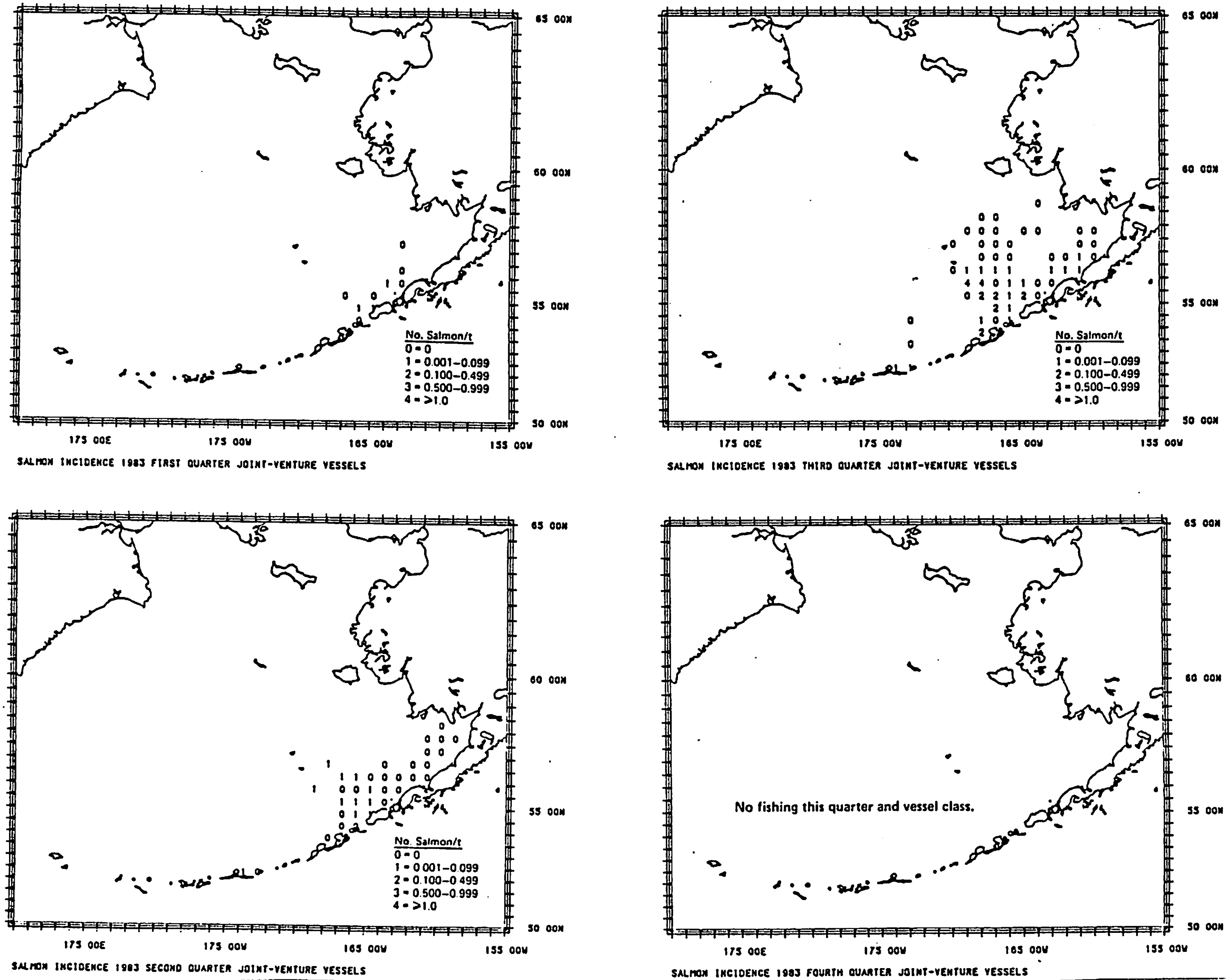

Figure 4.--Average incidence (no./t) of salmon in the joint-venture fisheries by quarter and 2° lat. by 1° long. areas, 1983.

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Table 5.--Estimated numbers of salmon and tonnage of groundfish landed in the Bering Sea/Aleutian region joint-venture fishery in 1984 by month and management area.

Month	Estimated Numbers of Salmon				Total Groundfish Catch			
	Total (Nos.)	1 (Nos.)	2 (Nos.)	4 (Nos.)	Total (t)	1 (t)	2 (t)	4 (t)
Jan.	3	3	-	-	269.9	269.9	-	-
Feb.	53	53	-	-	4,830.6	4,830.6	-	-
Mar.	427	427	-	-	40,437.6	40,437.6	-	-
Apr.	808	798	-	10	53,472.9	51,108.9	-	2,364.0
May	15	1	0	14	20,598.8	8,406.6	52.9	12,139.3
Jun.	228	147	0	81	57,354.1	39,997.2	2,145.7	15,211.2
Jul.	1,523	1,419	91	13	89,521.3	41,258.9	34,536.3	13,726.1
Aug.	57,008	56,909	71	28	70,991.5	54,849.4	8,073.7	8,068.4
Sep.	494	491	-	3	23,048.5	22,410.8	-	637.7
Oct.	14	14	-	-	1,197.5	1,197.5	-	-
Nov.	0	0	-	-	45.0	45.0	-	-
Dec.	-	-	-	-	-	-	-	-
Total	60,573	60,262	162	149	361,767.7	264,812.4	44,808.6	52,146.7

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are from rivers in Western Alaska and destined to return to traditional fisheries in terminal areas in subsequent years. Most chum salmon stocks in the region are in relatively healthy condition and the high seas bycatch would not constitute a resource conservation problem. Certain stocks, for example Yukon River fall chums, are far below optimum production levels and some components of that stock are more than 50% below escapement goals. Yukon fall chum salmon are the subject of major allocation disputes among traditional users as well.

3. ESTABLISH MEASURES TO REDUCE THE INCIDENTAL BYCATCH OF FULLY UTILIZED DOMESTIC SPECIES BY FOREIGN TRAWLERS IN THE ALEUTIAN ISLANDS

U.S. fishing and processing companies operating in the Bering Sea and Aleutian Islands have expanded dramatically in recent years. For example, in 1981 joint ventures in the Aleutian Islands caught approximately 3,800 mt of groundfish (Table 6). This catch reached 19,000 mt in 1982 and climbed to over 50,000 mt in 1984. This rapid increase in domestic harvest has led

Table 6. Joint venture and foreign trawl catches in the Aleutian Islands (INPFC Area 4), 1981-84.

	Pollock	Pacific cod	Atka Mackerel	POP	Sablefish	All Species
Joint Venture						
1981	145	1,749	1,633	0	156	3,769
1982	1,983	4,280	12,429	2	118	19,043
1983	2,547	4,700	10,511	10	70	18,051
1984*	6,736	6,476	35,927	429	272	50,251
Foreign Trawl						
1981	55,346	2,680	15,027	3,660	172	88,362
1982	55,745	1,520	7,117	1,732	147	77,252
1983	56,453	1,870	1,097	651	155	69,663
1984*	71,452	437	71	390	115	75,473

*preliminary

to full utilization of several groundfish species and greatly increased utilization of others. The Council has identified three species as fully utilized by U.S. fishermen: Pacific ocean perch, sablefish, and Atka mackerel. Pacific cod, while not yet fully utilized in the Aleutians, is also of great economic importance. These species have supported foreign directed fisheries in the past and, although directed fisheries have been curtailed due to reduced allocations, are still taken in varying quantities incidentally to normal groundfish trawl operations. Because these species are important to the development of the U.S. industry, reduction of foreign catches to a minimum is esessential. Modification of fishing practices can reduce these incidental catches but elimination of bycatches by that method alone is doubtful.

Data from recent years indicate that a substantial portion of the foreign catch of these fully utilized species in the Aleutian Islands has been taken in the immediate vicinity of the islands themselves. In 1983 foreign trawlers harvested a total of 1,870 mt of Pacific cod, 155 mt of sablefish, 738 mt of Pacific ocean perch, and 1,097 mt of Atka mackerel in the Aleutian Islands (Statistical Area 4). Preliminary analysis of observer data for the 1983 fishing year indicate that 92% of the trawl catches of Pacific cod, 88% of sablefish, 92% of rockfish and 66% of Atka mackerel came from within 20 miles of the islands in 1983. The Council feels that it is important to ensure that these valuable species be harvested entirely by U.S. fishermen and is investigating measures to achieve that goal.

4. ESTABLISH A REPORTING SYSTEM FOR CATCHER/PROCESSOR VESSELS

The objective of this proposal is to ensure that fishery managers receive timely estimates of catch by all domestic vessels so that fishery closure notices can be promptly issued when OY's are achieved. With the rapid recent growth of the domestic fishing fleet, increasing importance is being placed on timely reporting of domestic harvests in order to ensure that OY's are not exceeded. Vessels which deliver their catch to shore-based processors land their catch frequently enough to allow timely estimation of total catch under existing regulations. However, vessels which process their catch at sea can remain on the fishing grounds for extended periods of time. Catch reports submitted by these vessels at the time of landing as required under existing regulations are not timely enough to prevent OY's from being seriously exceeded. The resulting overharvests could seriously damage future production from groundfish stocks.

Current fishing regulations implementing the Gulf of Alaska and Bering Sea Fishery Management Plans require fishing vessels to submit a State of Alaska fish ticket or equivalent document to the Alaska Department of Fish and Game for any commercial groundfish harvest in the Gulf of Alaska or Bering Sea within 7 days of the date of landing the catch. Vessels which preserve their catch by non-freezing refrigeration or icing methods must land their catch within a maximum of 10-12 days from the time of harvest in order to ensure product quality. The catch from these vessels, when delivered to shore- based processors, can be reported on a timely basis under existing regulations. If existing regulations are properly enforced, fishery managers can estimate harvests by these vessels with sufficient precision to ensure that OY's are not exceeded.

However, vessels which freeze or salt their catch aboard frequently remain at sea for trips of several months duration and are not currently required to report their catch until the time of landing and offloading. At least twenty two catcher/processor vessels will be operating in the Gulf of Alaska and Bering Sea areas in 1985. Based on past catcher/processor landing records the combined hold capacity of these vessels will be approximately 13,000 metric tons. Therefore these vessels are capable of harvesting significant portions or even entire OY's in a single trip. Under existing fishing regulations, fishery managers have no knowledge of the catch aboard these vessels until the time of landing. In addition, vessels are not required to notify fishery managers when beginning fishing operations. Since domestic groundfish fishing vessels are also not marked for identification from enforcement overflights, the number of catcher/processor vessels actually fishing in a given management area is not known until the time of landing. Without knowledge of effort levels, fishery managers are not able to make projections of catch aboard based on past performance.

Delayed catch reporting is also a problem for fully domestic mothership operations. In these operations small catcher vessels without processing capability deliver their catch, usually by cod-end transfers, to a mothership/processor vessel. Current regulations require that an ADF&G fish ticket be filled out each time a catcher vessel delivers to the mothership/processor and that these fish tickets be forwarded to ADF&G within 7 days of the date that fish were delivered. Domestic mothership and floating processor operations thus far have all occurred in sheltered waters with at least periodic access to U.S. mail service so that regulations requiring filing of fish tickets with ADF&G within 7 days could have been enforced. However, there is a potential for these mothership operations to occur at sea, with no method of filing the fish tickets with ADF&G within the 7 day period required by law.

With such large processing capacities and increasing numbers of catcher/processor and mothership/processor vessels the risks of overharvesting groundfish resources under the current system are high. Because of the time delays involved in catch reporting under current regulations, groundfish resources could be drastically overharvested before fishery managers had even discovered that OY's had been exceeded. Since many of the groundfish species concerned are slow growing and long-lived, overharvesting can have considerable impacts on future production.

5. REDUCE THE SPECIFIED GROUNDFISH RESERVE FROM 15 PERCENT TO 10 PERCENT OF THE ANNUAL OPTIMUM YIELD

This proposal would facilitate the management process by providing more groundfish for harvest at the beginning of each year. Such provision would enhance industrial planning by reducing the amount of uncertainty as to the amount of groundfish by species that will be available for harvest. At present, 15 percent of the TAC from the groundfish complex is set aside as reserve at the beginning of each year. For 1983, 1984 and 1985 when TAC reached 2.0 million mt, the reserve was set at 300,000 mt, because TAC reached 2.0 million mt. Amounts of each groundfish species may be released to DAH during anytime in the year and to TALFF at designated review periods after April, June, and August. An excessive reserve, complicated by postponed and delayed reserve releases, reportedly has added another layer of uncertainty to the availability of surplus yield that may be apportioned to the foreign fishery.

The reserve under Amendment 1 was originally proposed at 10 percent. The 15 percent reserve was approved by the Council during its May 1982 meeting. Uncertainties about the status of stocks and U.S. fishing progress at that time justified a 15 percent reserve. However, conditions in the fishery have since changed, and a 15 percent reserve is no longer necessary. These conditions are:

* The groundfish resource has been steadily improving since initial approval of the 15 percent reserve. More reliable scientific information based upon 8 years of management under the Magnuson Act have reduced the risk of overfishing on individual species. A 10 percent reserve (200,000 mt) would be more than adequate to handle any unexpected changes in resource conditions or errors in the estimation of EY's.

* Recent amendments to the Magnuson Act require the Secretary of State to withhold at least 50 percent of the initial allocation to each nation from the beginning of the year. This withheld portion of a nation's allocation is placed in a new category of fish known as "unallocated TALFF". Any subsequent releases of unallocated TALFF to a nation can only be made after sufficient time has elapsed to evaluate the nation's compliance with certain allocation criteria. The unallocated TALFF in effect establishes an additional buffer of fish between the reserve and a national allocation. Fish transferred from the reserve is first placed into unallocated TALFF before it is allocated to a foreign nation. This provides the Regional Director with greater flexibility to monitor the progress of a nation's fishery to determine its specific needs from reserve, especially for those species which are incidental to the target fisheries. With this large buffer of fish established by the unallocated TALFF, an additional 5 percent reserve is no longer necessary as originally anticipated.

* As previously noted, the reserve is not designated by species. The purpose of the undesignated reserve is to provide greater flexibility in the management of the fishery. The Regional Director now has greater flexibility in designating reserves for unexpected expansion in the domestic fishery and correction of operational problems, and adjusting individual

TAC's in accordance with the most recent biological information available during the fishing year. Given this greater management flexibility with an undesignated reserve, a 10 percent reserve will be adequate.

6. IMPLEMENTATION OF THE NMFS HABITAT POLICY

The proposed action amends the FMP by modifying and adding certain sections specifically to address the habitat requirements of individual species in the Bering Sea/Aleutian Islands groundfish fishery. The amendment describes the diverse habitat types within the Gulf of Alaska, delineates the life stages of the species, identifies potential sources of habitat degradation and the potential risk to the fishery, and describes existing programs, applicable to the area, that are designed to protect, maintain, or restore the habitat of living marine resources. The amendment responds to the Habitat Conservation Policy of the National Marine Fisheries Service, which advocates emphatic consideration of habitat concerns in the development or amendment of FMP's, and the strengthening of NMFS' partnerships with states and the councils on habitat issues.

III. ALTERNATIVE MANAGEMENT MEASURES INCLUDING THOSE PROPOSED

1. INCREASE THE UPPER END OF THE OY RANGE

A. (Alternative 1 = proposed). Increase the upper end of the OY range to 2.5 million mt.

This alternative would provide the Council and the Secretary broader flexibility to make groundfish available for harvest during years when the biological status of stocks justified a harvest larger than 2.0 million mt.

B. (Alternative 2 = status quo). Maintain the upper end of the OY range at its current level of 2.0 million mt.

This alternative maintains the conservative management system that was implemented by Amendment 1 to the FMP. It provides the Council and the Secretary with limited flexibiltiy to make groundfish available for harvest when the status of stocks would justify a larger harvest.

2. REDUCE THE INCIDENTAL CATCH OF CHUM SALMON BY JOINT VENTURE TRAWLERS

Two management alternatives and the status quo may be considered to reduce the incidental catch of salmon.

A. (Alternative 1 = proposed). Close the area from 55°N-56°30'N latitude between 164°W-169°W longitude from July 20-August 25.

This alternative would respond to the problem identified in the above Statement of Need. In 1983 the highest catch rates of salmon (number of salmon per metric ton of groundfish) occurred from 54°N- 56°N latitude between 166°W-169°W longitude. In 1984 the largest catches (in total numbers) occurred from 55°-56°N between 165°-166°W. The majority of the catch occurred from 55°-56°N between 164°W-167°W. As in 1983, more than 92% of the incidental salmon catch by joint venture vessels occurred in July and August.

B. (Alternative 2). Close the same area during the same time period if a prohibited species catch (PSC) limit is reached.

This alternative would also respond to the identified problem, but would result in somewhat fewer salmon being saved (depending primarily on the the PSC limit). However it would allow fishermen the opportunity to modify their fishing gear and/or techniques in order to reduce their incidental catch and remain in the area. It is not certain how fishermen would respond to a PSC limit. Perhaps they would switch from pelagic trawling, i.e. pulling their nets above the ocean floor and preventing the gear from touch the bottom, to bottom trawling, i.e. dragging their nets in fairly constant contact with the ocean floor. This would be likely to increase the incidental catch of other prohibited species, primarily Pacific halibut (Hippoglossus stenolepis) and Tanner crab (Chionoecetes bairdi). However, these other groundfish trawl fisheries in this area and throughout the region also use bottom trawls, and this area is not known to have above average densities of crab and halibut, it is unlikely that the total catch of these two species will increase significantly.

C. (Alternative 3 = Status Quo).

Current regulations require fishermen to immediately release all salmonids with a minimum of injury and to minimize their total catch of salmon. No specific bycatch limitations are placed on domestic and unless joint venture trawlers modify their fishing gear, and/or techniques, it is likely that the incidental catch will continue to increase. Joint venture trawlers are expected to increase their pollock catch from about 250,000 mt in 1983 to nearly 400,000 mt in 1985, and this area has extremely high densities of pollock and associated high catch rates. Thus, the amount of pollock fishing in July and August in this area will undoubtedly increase.

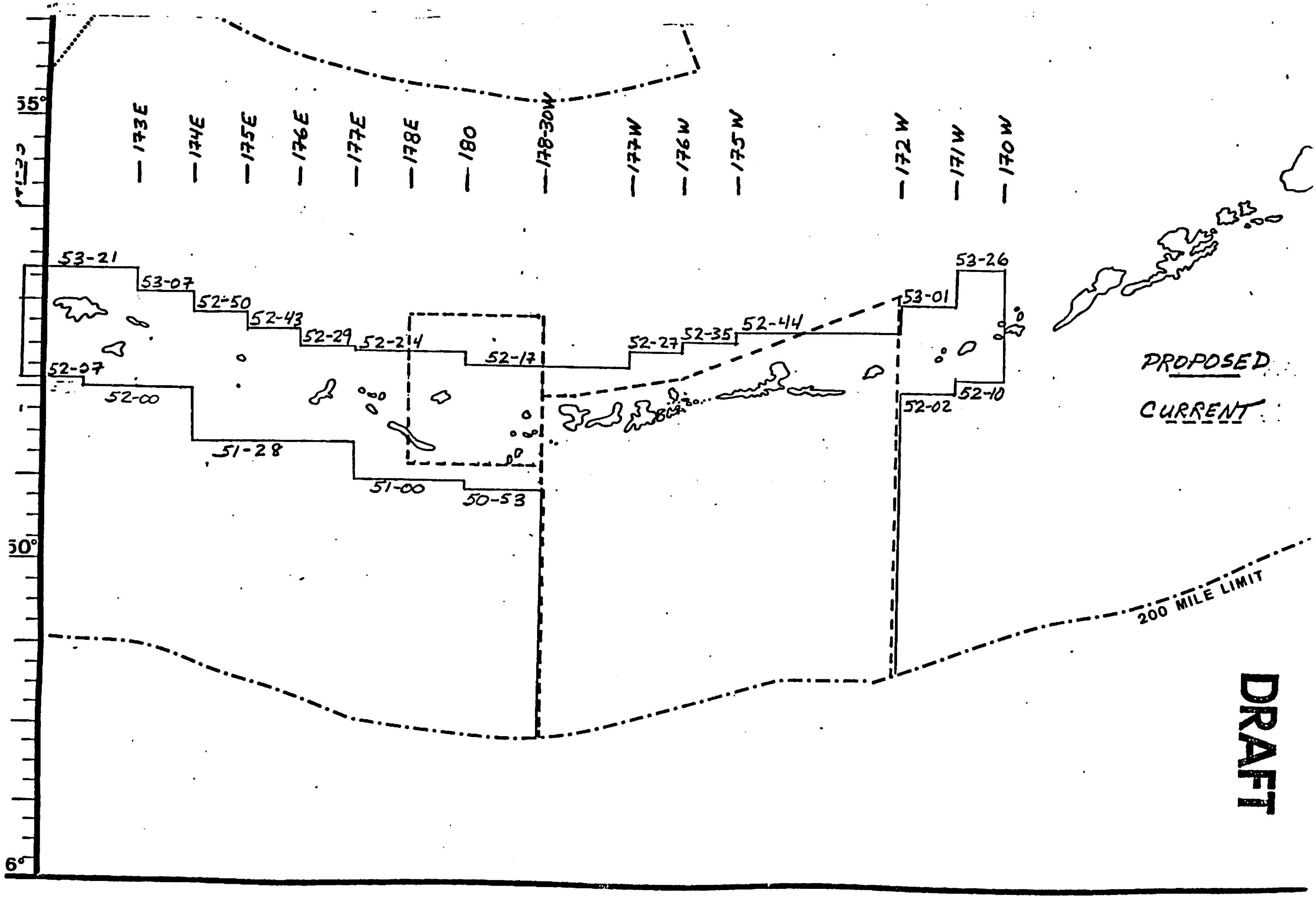
3. REDUCE THE INCIDENTAL BYCATCH OF FULLY UTILIZED DOMESTIC SPECIES BY FOREIGN TRAWLERS IN THE ALEUTIAN ISLANDS

A. (Alternative 1 = proposed) Prohibit foreign trawling within 20 miles of the Aleutian Islands.

Under this alternative, foreign trawl catches of Pacific cod, sablefish, Pacific ocean perch, and Atka mackerel would be reduced, thus making them more available to domestic fishermen. The exact location of the proposed closure is shown in Figure 5.

B. (Alternative 2) Allow foreign trawlers to fish in those areas around the Aleutians that are currently open to such fishing.

Under this status quo alternative, foreign nations could continue to trawl for their share of groundfish quotas that are apportioned to TALFF, including bycatch amounts of Pacific cod, sablefish, Pacific ocean perch, and Atka mackerel. Each nation would be subject to early closures of its fishery it its share of these limiting species were caught.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PROPOSED
CURRENT
200 MILE LIMIT
173E
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177E
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180
178-30W
177W
176W
175W
172W
171W
170W
53-21
53-07
52-50
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52-29
52-24
52-17
52-27
52-35
52-44
53-01
53-26
52-10
52-02
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52-00
51-28
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50-53
55°
50°

FIGURE 5

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4. ESTABLISH A REPORTING SYSTEM FOR CATCHER/PROCESSORS

A . (Alternative 1 = proposed). Require an FCZ processing permit with check- in/check-out and weekly catch reporting.

Under this alternative, catcher/processor and mothership/processor vessels would be required to obtain an FCZ processing permit. These catcher/processor and mothership/processor vessels would be required to notify NMFS via U.S. Coast Guard radio each time they entered or left an FMP management area. Catcher/processor and mothership/processor vessel operators or their representatives would also be required to submit a report to NMFS by Coast Guard radio, U.S. mail, or telex for each fishing week documenting the hail weight estimates of catch by FMP species group in each FMP area. These weekly reports would be due within 7 days of the end of the fishing week. ADF&G fish tickets would continue to be required to be submitted within one week of the date of landing to document more precise catch or product weights and specific ADF&G statistical areas. A completed logbook may be submitted with the ADF&G fish ticket showing total catch by species for a trip as a means of documenting catch by specific ADF&G statistical area.

B. (Alternative 2 = status quo). Maintain the current reporting requirements.

With the present system catches are reported on ADF&G fish tickets at the time of landing.

C. (Alternative 3). Require an FCZ processing permit with a weekly catch report, but without check-in/check-out reporting.

Under this alternative, catcher/processor and mothership/processor vessels would be required to obtain an FCZ processing permit. These catcher/processor and mothership/processor vessel operators or their representatives would be required to submit a report to NMFS by Coast Guard radio, U.S. mail, or telex for each fishing week documenting the hail weight estimates of catch by FMP species group in each FMP area. These weekly reports would be due within 7

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days of the end of the fishing week. ADF&G fish tickets would continue to be required to be submitted within one week of the date of landing to document more precise catch or product weights and specific ADF&G statistical areas. A completed logbook may be submitted with the ADF&G fish ticket showing total catch by species for a trip as a means of documenting catch by specific ADF&G statistical area.

D. (Alternative 4). Place observers aboard a portion of the catcher/processor and mothership/processor vessels and extrapolate the catch from these vessels to the entire fleet.

Under this alternative, catcher/processor and mothership/processor vessels would be required to obtain an FCZ processing permit which would require that observers be allowed onboard if requested. These catch/processor and mothership/processor vessels would be required to notify NMFS via U.S. Coast Guard radio each time they entered or left an FMP management area. Observers would be placed aboard a portion of the catcher/processor and mothership/processor vessels. Radio reports of catch from the observed sample would be extrapolated to all vessels in each management area. ADF&G fish tickets would continue to be required to be submitted within one week of the date of landing to document more precise catch or product weights and specific ADF&G statistical areas. A completed logbook may be submitted with the ADF&G fish ticket showing total catch by species for a trip as a means of documenting catch by specific ADF&G statistical area.

E. (Alternative 5) Place observers aboard all catcher/processor and mothership/processor vessels.

Require catcher/processor and mothership/processor vessels to obtain an FCZ processing permit which would require that an observer be aboard at all times. Total catch would be computed directly from observer radio reports.

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5. REDUCE THE SPECIFIED GROUNDFISH RESERVE

A. (Alternative 1 = proposed). Reduce the reserve from 15 percent to 10 percent of the annual optimum yield.

This alternative would make more groundfish available by species basis at the beginning of the fishing year for apportionment among DAP, JVP, and TALFF. Operational planning by the domestic and foreign user groups could be faciliated if they were more certain about amounts actually available for harvest.

B. (Alternative 2 = status quo). Maintain the reserve at its current specification of 15 percent.- This alternative maintains the current percentage of the annual optimum yield that is allocated to the nonspecific reserve. This percentage was first implemented to conservatively account for errors in stock estimates and/or in assessments of DAH.

6. IMPLEMENTATION OF THE NMFS HABITAT POLICY

A. (Alternative 1 = proposed). Amend the FMP to address habitat considerations, based on the best available information, to meet standards ser forth in the National Marine Fisheries Service's Habitat Conservation Policy.

This alternative is preferred, because it provides a basis for better conservaiton and managment of the Bering Sea/Aleutian Islands groundfish fishery.

B. (Alternative 2 = status quo). Do not amend the FMP to address habitat considerations.

This alternative is not acceptible, because conservation and management of the fishery resources requires increased understanding of habitat issues.

IV. ENVIRONMENTAL IMPACTS OF THE AMENDMENT PROPOSALS AND THEIR ALTERNATIVES

Environmental impacts on the quality of the human environment are categorized as biological, physical, and socioeconomic. The socioeconomic analysis is presented under the draft Regulatory Impact Review/Initial Regulatory Flexibility Analysis prepared for Amendment 10. Biological and physical impacts are discussed as follows:

1. INCREASE THE UPPER END OF THE OY RANGE.

Impacts caused by a change in the OY range are categorized as stress to groundfish populations, stress to marine mammals, stress to marine birds, and physical changes as a direct result of on-bottom fishing practices, and nutrient changes due to processing and dumping of fish wastes. These impacts are discussed as follows:

A. Increase the upper end of the optimum yield range to 2.5 million mt.

<u>Stress To Groundfish Populations</u>

The EY for the groundfish complex is usually calculated on a species-by-species basis and summed for the groundfish complex. These calculations account for amounts consumed by other groundfish, i.e., fisheries are only allowed on surplus production, which should not adversely impact the wellbeing of groundfish populations directly. When TAC is set equal to EY for the complex, achievement of the EY for all species simultaneously is impossible for the multispecies trawl-dominated fishery. Consequently, total catches should never achieve the combined EY's for the groundfish complex. Since the estimates of EY will continue to form the biological limit for setting of TAC's for the groundfish complex, the present management system will always assure maintenance of a larger resource biomass than otherwise would be the case and a "biological cushion" will always exist to compensate for variations and errors in EY determinations. If the OY range is changed to 1.4-2.5 million mt, the Council would have greater management flexibility to more fully utilize the resource when stock conditions warrant it. The Council would be required, however, to set TAC equal to EY whether or not the OY range is changed. The Council could still consider such factors as biological, environmental, and socioeconomic in setting TAC's below, at, or above EY's.

Stress to Marine Mammals

The pinniped species that are found in the Bering Sea/Aleutians are all protected by the Marine Mammal Protection Act of 1972 (MMPA). All species are believed to be at their level of optimum sustainable population as defined under the MMPA so that permits for their taking may be issued under carefully limited circumstances. Because groundfish trawl operations generally do involve conflict with pinnipeds, domestic and foreign fishermen proposing to engage in such operations must obtain Certificates of Inclusion under a general permit for the taking of marine mammals incidental to commercial trawling operations. Under the general permit not more than northern sea lions (*Eumetopias jubatus*), northern fur seals (*Callorhinus ursinus*), harbor seals (*Phoca vitulina*), and small cetaceans may be killed or seriously injured annually by domestic trawl operations off Alaska.

Numbers of marine mammals taken in the eastern Bering Sea during 1984 were well within the limits provided by the Certificates of Inclusion. A total of 73 and 96 marine mammals were reportedly taken during the joint venture and foreign fisheries, respectively. U.S. fishermen now have several years of experience in the Bering Sea groundfish fishery and are mostly familiar with the protection afforded marine mammals. Because marine mammals are usally highly visible during daytime, fishermen are able to avoid them while trawling, thus minimizing confrontations. Observations by the National Marine Fisheries Service suggest, however, that trawling conducted during periods of darkness is likely to increase encounters with marine mammals. Potential methods to reduce such encounters include (1) scheduling fishing operations to reduce or eliminate the need to trawl during periods of darkness, and (2) adopting certain technical devices, e.g.. noise emitters, that would repel marine mammals in the vicinity of the a trawl. Fishermen should be encouraged continually to consider and adopt such measures to mitigate the effect of their operations on sea lions in order to enjoy fishing activities without additional measures that could be imposed on them under the Marine Mammal Act.

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Ecosystem models that were used to calculate MSY for the groundfish complex take into account the competition for food that occurs between marine mammals and commercial fishing operations. Therefore, raising the OY or TAC to 2.5 million mt. should not deprive food for marine mammal populations. Eleven species of marine mammals (Table 7) and eight fish species or fish groups in the eastern Bering Sea could be affected by commercial fishing (Proceedings of the Workshop on Biological Interactions Among Marine Mammals and Commercial Fisheries in the Southeastern Bering Sea, and Alaska Sea Grant Report (University of Alaska 1984).

Table 7. Marine mammals and commercial fish species in the Eastern Bering Sea that interact as a result of commercial fishing operations.

Marine mammals	Fish species
Northern fur seal (Callorhinus ursinus)	Pollock
Steller sea lion (Eumetopias jubatus)	Pacific cod
North Pacific walrus (Odobenus rosmarus)	Yellowfin sole
Harbor seal (Phoca vitulina)	Turbot
Spotted seal (Phoca largha)	Other flounders
Ribbon seal (Phoca fasciata)	Halibut
Bearded seal (Erignathus barbatus)	Rockfish
Beluga whale (Delphinapterus leucas)	Sablefish
Dall porpoise (Phocoenoides dalli)	
Harbor porpoise (Phocoena phocoena)	
Gray whale (Eschrichtius robustus)	

Types of interactions between marine mammals and commercial fishing operations are divided into four categories as follows:

a) Direct effects on marine mammals from shooting, harassment, incidental entanglement during fishing operations, and/or entanglement in lost or discarded fishing gear;

b) Direct effects on fisheries when marine mammals take or damage caught fish, and/or damage fishing gear;

c) Indirect effects on marine mammals caused by fisheries reducing the quantity or quality of prey species available to marine mammals; and

d) Indirect effects on fisheries caused when marine mammals reduce the quantity or quality of fish available to fisheries.

Except for entanglement in lost or discarded fishing gear, direct interactions are reasonably well documented and/or are the subject of ongoing or planned assessment. Categories c) and d), indirect ecological interactions as a result of changes in predators and prey species, are less well understood. Many of the marine mammals feed on juvenile and adult groundfish and also on the same animals that the same groundfish feed on. Harvesting an increased amount of groundfish should not leave a deficit of fish in the system that marine mammals would then forego, because the groundfish stocks themselves would have increased. Theoretically, these increases in allowable levels of harvest should have a zero net effect on marine mammals; in reality, predator/prey relationships are not well understood and any resulting changes are not possible to measure against natural perturbations in the ecosystem, given the existing technology to measure them.

Interactions are most common in the following combinations of marine mammals and commercial fisheries:

Northern fur seal -- pollock/cod
Steller sea lion -- pollock/cod; yellowfin sole/flounder
Harbor seal -- yellowfin sole/flounder

The nature of these interactions are summarized as follows:

Northern Fur Seal and the Pollock/Cod Fishery - Fur seals prey primarily upon the one- and two- year-old-classes of pollock, whereas the fishery preferentially takes the larger size-and age-classes of pollock. Ecological interactions likely are greatest in the vicinity of the Pribilof Islands during the fur seal pupping/breeding season. The Pribilof Island fur seal population has been declining since the mid-1950's. The harvest of females in the late 1950's and early 1960's accounts for much of the decline; and, while not proven, entanglement in lost or discarded fishing gear could be a major cause of the continued decline. Obtaining the necessary biological/ecological information to predict the probable numerical and functional relationships between the northern fur seal population, the pollock/cod fishery, and the affected fish stocks would be difficult and perhaps impossible. In such cases, baseline/monitoring programs should be conducted to detect and monitor possible harvest-caused changes in key population or system parameters.

Steller Sea Lion and the Pollock/Cod Fishery - Steller sea lions apparently are caught and killed in lost and discarded fishing gear. Unlike the northern fur seal, the Steller sea lion is present in the eastern Bering Sea year-round. The distribution, origins, trends and diet of Steller sea lions in the Bering Sea are not well documented. What little is known about their diet is from outside the Bering Sea and indicates that all sizes of pollock, 5 cm to 60 cm, are eaten. Some dietary informtion is from animals caught incidentally in the cod end of trawl nets and may be biased since sea lions are known to be attracted to, and feed in, the vicinity of fishing and processing vessels. Too little is known about entanglement in lost and discarded fishing gear and about the distribution, feeding habits, and food requirements of Steller sea lions in the eastern Bering Sea to do more than speculate about the possible direct and indirect effects of the pollock/cod fishery on the eastern Bering Sea population(s) of Steller sea lions.

Steller Sea Lion and the Yellowfin Sole/flounder Fishery - Little information exists on the diet of sea lions in the Bering Sea. However, flounders are known to be insignificant in the diet of sea lions in the Gulf of Alaska, and therefore believed to be insignificant in the Bering Sea, also. Although approximately 8 percent of the estimated standing stock of yellowfin sole is harvested annually, a flounder harvest of any size is not likely to affect sea lions.

Harbor Seal and the Yellowfin Sole Fishery - The harbor seal is a coastal species inhabiting nearshore areas where foreign fisheries are prohibited or restricted to joint ventures with U.S. fishermen. Thus, harbor seals probably have not affected the yellowfin sole fishery or be affected by the yellowfin sole fishery unless there is a substantial expansion of the domestic sole or other nearshore fisheries in the eastern Bering Sea. The nature and size of inshore domestic fisheries, the movements, feeding habits, and diet of harbor seals, the existence, location and characteristics of definable harbor seal feeding areas, and the genetic relationship between harbor seal colonies in the eastern Bering Sea and elsewhere are not well documented.

Changes in optimum yields are calculated to account for amounts consumed by marine mammals, i.e., fisheries are only allowed on surplus production, which should not impact directly marine mammals. On the other hand, certain conflicts occur between marine mammals and fishermen as a result of both "predators" being on the same grounds, sometimes in direct competition with each other.

Stress to Marine Birds

Harvesting operations during the groundfish fisheries may cause marine birds, including those protected by the Migratory Bird Treaty Act, to avoid areas that they might otherwise frequent. Such displacement of these birds would not appear to be a prohibited taking for purposes of the Migratory Bird Treaty Act, but its long-term effect on them is largely unknown. Birds protected under this act could theoretically be captured in trawl gear in the course of their feeding activities. Any such capture that is intentional or negligently caused by fishermen would be a violation of this Act.

As with marine mammals, many of the marine birds that occur in the Bering Sea/ Aleutians feed on juvenile and adult groundfish and also on other animals that the same groundfish feed on. Harvesting an increased amount of groundfish should not leave a deficit of fish in the system that marine birds would then forego, because the groundfish stocks themselves would have declined. These increases in allowable levels of harvest should have a zero net effect on marine birds, but these relationships are not well understood.

Physical changes As a Direct Result Of On-bottom Fishing Practices

Under this alternative an additonal 500,000 mt could be harvested. Depending on the species, this harvest could entail certain combinations of trawls (on-bottom and midwater), longlines, pots, and gillnets. Only the bottom trawl has been identified as a gear type that impacts the bottom. It may cause abrasion of the bottom as it is pulled along, killing or injuring any animals and plant life that may have been in its path. Most bottom trawls are also equipped with rollers, or bobbins, that protect the trawl from damage, but which may also kill or injure animals and plant life. The actual severity of such impacts are not known, but are largely believed to be insignficant over the long term, given the capacity of the ecosystem to repair itself.

Nutrient Changes Due to Processing and Dumping Fish Wastes

Under this alternative, 2.5 million mt of groundfish could be caught. Assuming a recovery rate of 30 percent, this harvest could result in 1.75 mt of fish wastes, or 0.35 million additional metric tons, being discarded at sea compared to 1.4 mt of wastes that could be discarded in association with a 2.0 million mt harvest. This additional amount represents a 25 percent increase. Processes of change in the ocean are dynamic given the biological and physical interactions that occur. An assessment of the true effects caused as a result of this increase are not quantifiable given present technology.

B. Maintain the upper end of the OY range at 2.0 million mt.

Impacts caused by maintaining the upper end of the OY range at 2.0 million mt fall under the same categories as under the proposed alternative, i.e. direct stress to marine mammal and bird populations, changes in predator/prey relations between vertebrates and invertebrates, and changes in status of marine mammals and birds, physical changes as a direct result of on-bottom fishing practices, and nutrient changes due to processing and dumping of fish wastes. These impacts are discussed as follows:

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Stress to Groundfish Populations

Assuming results of population models or biological surveys show the total annual harvest should be set at no more than 2.0 million mt, then the same types of impacts on groundfish should occur. These impacts, however, would likely be reduced proportionately. Such a reduction in impacts would be expected, because calculations of the annual OY would already have factored in the biological requirements of groundfish populations. Unpredictable, however, are the following variables in the ecosystem: temperature, currents, light, availability of primary and secondary nutrients, and subtle changes in predator/prey relationships. These variables make accurate predictions of stock conditions on the basis of modeling difficult. If conditions of stocks improved in any one year to justifiy a harvest of more than 2.0 million mt, then certain amounts of fish will be left on the grounds. This unharvested surplus would be consumed by animals, which would introduce some instability, since the ecosystem would respond by increasing its production until the ecosystem came back into equilibrium.

Stress to Marine Mammals and Birds

As with groundfish populations, the same types of impacts on groundfish should occur. If conditions of stocks improved in any one year to justifiy a harvest of more than 2.0 million mt, then certain amounts of fish will be left on the grounds. This unharvested surplus would be consumed by marine mammals and birds, introducing some instability until the system responded by increasing its production.

Food Competition with Marine Mammals and Birds

Under this alternative, fishermen would be limited to no more than 2.0 million mt. During some years when the condition of stocks would allow a harvest of more than the upper limit of 2.0 million mt, a surplus of groundfish biomass would be available in the system. Competition between fishermen and marine mammals and birds would be lessened during such years.

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Nutrient Changes Due to Processing and Dumping Fish Wastes

Under this alternative, 2.0 million mt of groundfish could be caught. Assuming a recovery rate of 30 percent, this harvest could result in 1.4 million mt of fish wastes, or 0.35 million fewer metric tons, being discarded at sea compared to 1.75 million mt of wastes that could be discarded in association with a 2.5 million mt harvest. This lesser amount represents a 20 percent increase. Processes of change in the ocean are dynamic given the biological and physical interactions that occur. An assessment of the true effects caused as a result of this decrease are not quantifiable given present technology.

2. REDUCE THE INCIDENTAL CATCH OF CHUM SALMON BY JOINT VENTURES

No significant changes in predator-prey relationships among vertebrates or invertebrates are expected to occur under any of the alternatives being considered, other than those anticipated and analyzed in the Environmental Impact Statement for the FMP. Joint venture fishing activity has replaced foreign fishing activity and not been in addition. Shifts between areas may lead to minor changes in localized abundance of certain stocks, primarily those of commercial importance to the trawl fishing industry. No physical changes in the environment are anticipated. No increased direct stress to marine mammals or birds is expected, nor is any change in indirect stress anticipated. If trawling practices change within the area of concern, such as shifting from midwater to bottom trawling, some changes in the composition of the benthic community may occur. Any such changes are expected to be minor.

The stock origin of the chum salmon being intercepted by joint ventures is unknown at this time. A wide variety of stocks is probably in the area during July and August. Stock origin studies based on scale pattern analysis and limited high seas tagging have been conducted in nearby areas, but these studies have focused primarily on maturing fish during May, June, and early July. These studies have indicated a mix of Asiatic (primarily Japanese) and Alaskan stocks are present in the Bering Sea and Aleutian Islands and that this mix varies from area to area and from time to time. Chum salmon exhibit an extraordinary migratory nature, as evidenced by the single coded-wire tag recovery by U. S. observers onboard a joint venture processing ship. That tag came from a hatchery in Hood Canal (Puget Sound), Washington.

The vast majority of chum stocks in the western Alaska area are in very healthy condition, some at or near record levels. It is possible that a portion of these intercepted chum salmon are from depressed stocks such as certain Yukon River fall chum stocks, however. Given the small percentage of the total western Alaska chum population that could be involved, it is unlikely that this incidental catch would contribute significantly to this depressed condition. It appears rather that this is primarily an allocation issue, and this aspect is dealt with in more detail in the Regulatory Impact Review.

3. CLOSE THE AREA WITHIN 20 MILES OF THE ALEUTIAN ISLANDS TO FOREIGN TRAWLING.

The environmental impacts of replacing foreign trawling with domestic fishing (mostly trawling) are expected to be negligible. No increased direct stress to marine mammals and birds is expected. No changes in the effects on endangered species or the coastal zone are expected. This issue is primarily allocational in nature and is considered in greater detail in the Regulatory Impact Review.

4. ESTABLISH A REPORTING SYSTEM FOR CATCHER/PROCESSORS

The primary effects imposed upon the biological and physical environment by the catcher/processor reporting alternatives result from the varying potential for overfishing under each alternative. Both targetted groundfish species and non-targetted incidental or prohibited species could be overfished by catcher/processor and mothership/processor vessels. Since many of the groundfish species concerned are slow growing and long-lived, overharvesting can have considerable impacts on future population levels and production of the targetted groundfish species. Similar effects on population levels and production are possible for incidental and prohibited species catches by these vessels. In addition, considerable socio-economic impacts on catches by other user groups could result from excessive harvests of prohibited species by catcher/processors, particularly for crab, salmon and halibut. Secondary biological impacts of overharvests would result from changes in trophic interactions caused by the altered population levels of the overfished species.

The potential for resource depletion through overfishing results from the large hold capacities of the catcher/processor and mothership/processor vessels and the potential for these vessels to remain at sea for long periods of time. Under alternative 1, fishery managers have no knowledge of the catch aboard these vessels until the time of landing. By the time these vessels land, OY's and possible PSC levels could have been greatly exceeded by the aggregate catch aboard the catcher/processor vessels and shore-based domestic vessels. Alternative 2 would greatly reduce the risk of overfishing of targetted groundfish species by requiring weekly catch reports from the catcher/processor and mothership/processor vessels. In addition, this alternative requires vessels to check-in and check-out of each management area fished. This requirement increases the compliance and enforceability of this alternative, further reducing the risk of overfishing. Alternative 3 would require only the weekly catch report, with a somewhat larger risk of overfishing of targetted groundfish species, because of reduced compliance and enforceability. The risk of overfishing is also increased under alternative 3 because the precision of catch estimates is reduced. This results from catch projections for the most recent two week reporting period being based on a two week old effort distribution provided by the preceding catch report, rather than basing the effort distribution on current information from the check-in/check-out system. The onboard observer catch reporting of alternatives 4 and 5 provide the least risk of overfishing targetted groundfish species. Observer based catch reporting provides the only reduction of the risk of overfishing prohibited species catches of the alternatives.

5. REDUCE THE SPECIFIED GROUNDFISH RESERVE

A. Reduce the reserve from 15 percent to 10 percent of the annual optimum yield

AND

B. Maintain the reserve at its current specification of 15 percent.

Under both alternatives, a percent of the total TAC that is specified for the fishing year would be apportioned to the reserve. The reserve is used for (a) unexpected expansion of the domestic fishery, (b) correction of operational problems of domestic and foreign fishing fleets, and (c) unexpected adjustments of species TACs according to the condition of stocks during the fishing year. Both of these alternatives would impact the environment only indirectly, because the absolute amount that each species contributes to the reserve is a function of the TAC established by the Council for that species. Thus, any environmental impact would be directly related to the amount of TAC as it is allocated for harvest in any one fishing year and not to subsets of TAC. Such impacts fall under the analysis provided for Proposal No. 1, above.

6. IMPLEMENT THE NMFS HABITAT POLICY

This amendment is primarily descriptive in nature, focusing on the environment within which the product for harvest is generated and nurtured. It's purpose is to alert users of the marine environment to the elemental influence of habitat on the productivity of the fishery and to the potential for alteration by man's actions. The intended effect is to provide the basis for a common awareness among these users and for appropriate expressions of Council concern should the need arise. Because this statement is informational only, there is no immediate environmental impact, although the residual effect of increased knowledge may serve, in the long-term, to protect, maintain, or restore the habitats of the Gulf of Alaska groundfish fishery. In the absence of such an amendment, the benefits of increased public awareness of habitat issues would be lost.

V. EFFECTS ON ENDANGERED SPECIES AND ON THE ALASKA COASTAL ZONE

None of the alternatives for each managment proposal would constitute actions that "may affect" endangered species or their habitat within the meaning of the regulations implementing Section 7 of the Endangered Species Act of 1973. Thus, consultation procedures under Section 7 on the proposed actions and their alternatives will not be necessary.

Also, for the reasons discussed above, each of the alternative managment measures would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Zone Management Program within the meaning of Section 307(c)(1) of the Coastal Cone Management Act of 1972 and its implementing regulations.

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VI. FINDINGS OF NO SIGNIFICANT IMPACT

For the reasons discussed above, it is hereby determined that neither approval and implementation of any of the reasonable alternatives concerning the six topics presented would significantly affect the quality of the human environment, and that the preparation of an environmental impact statement on these actions is not required by Section 102(2)(C) of the National Environmental Policy Act or its implementing regulations.

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Assistant Administrator for Fisheries, NOAA   Date

DRAFT

VIII. COORDINATION WITH OTHERS

The following persons were consulted during the preparation of this environmental assessment: Dr. Loh-Lee Low, Northwest and Alaska Fishery Center, NMFS, Seattle, Washington and Patrick J. Travers, Alaska Regional Counsel, NOAA, Juneau, Alaska.

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North Pacific Fishery Management Council
Fishery Management Plan for the
Bering Sea/Aleutian Islands Groundfish Fishery

Outline for Habitat Sections of
Amendment #8/10

[4.0 Introduction to the Plan.
4.1 Description of Management Unit.]

4.2 Goals for Management Plan.
1. [Replace with habitat goal.]

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[9.0 Biological and Environmental Characteristics of the Fishery.]

9.8 Description of Bering Sea/Aleutian Island Groundfish Stocks: Introduction.
- 9.8.1 Discription of habitat types.
- 9.8.2 Habitat requirements.
  - 9.8.2.1 Walleye Pollock.
  - 9.8.2.2 Pacific cod.
  - 9.8.2.3 Yellowfin sole.
  - 9.8.2.4 Greenland turbot.
  - 9.8.2.5 Other flatfishes.
  - 9.8.2.6 Pacific ocean perch.
  - 9.8.2.7 Other rockfishes.
  - 9.8.2.8 Sablefish.
  - 9.8.2.9 Atka mackerel.
  - 9.8.2.10 Squid.
  - 9.8.2.11 Pacific Halibut.
- 9.8.3 Habitat areas of particular concern.
- 9.8.4 Habitat threats.
  - 9.8.4.1 Oil and gas development.
  - 9.8.4.2 Coastal development and filling.
  - 9.8.4.3 Marine mining.
  - 9.8.4.4 Derelict fragments of fishing gear and general litter.
  - 9.8.4.5 Organic enrichment.
  - 9.8.4.6 Ocean discharge and dumping.
  - 9.8.4.7 Benthic habitat damage by bottom gear.
  - 9.8.4.8 Contamination by heavy metals.
  - 9.8.4.9 Environmental stress indication.
- 9.8.5 Habitat protection: existing programs.
  - 9.8.5.1 Federal legislative programs and responsibilities.
  - 9.8.5.2 Specific actions for the BS/A groundfish fishery.
- 9.8.6 Habitat recommendations.
  - 9.8.6.1 General techniques to address identified problems.
  - 9.8.6.2 Specific recommendations.

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4.0 Introduction to the Plan.

4.1 Description of the Management Unit.

4.2 Goals for Management Plan.

1. Conserve and manage the groundfish fishery resources of the Bering Sea and Aleutian Islands to assure long-term productivity, maintenance of habitat quality and quantity, and consideration for interactions with other elements of the ecosystem. [This corresponds with Goal #1 as approved by the Council in December. It would replace Goal #1 as now written in the FMP.]

14.0 Management Regime.

14.1 Management Objectives.

E. Seek to maintain the productive capacity of the habitat required to support the Bering Sea/Aleutian Island groundfish fishery.

9.0 **Biological and Environmental Characteristics of the Fishery.**

9.8 **Description of Habitat of Bering Sea/Aleutian Island Groundfish Stocks: Introduction.** A fishery has been defined as a system made up of three interacting components - the aquatic habitat, the aquatic biota, and the human users of these resources (Lackey and Nielsen, 1980). However, since a fishery is most often described in terms of the product harvested (Rounsefell, 1975), productivity is likewise often exclusively described in quantitative harvest terms. The purpose of this section is to focus on the source of that productivity - that is, the environment (habitat) within which the product for harvest is generated and nurtured, the effect of man's actions on this environment, and thereby, the total productivity of the fishery.

The abundance and composition of fishery resources of a region are greatly influenced by the characteristics and quality of available habitat. The relationship between the components of a marine ecosystem can be altered by variations in physical and chemical processes, fluctuations in population dynamics, human activities, or the individual or combined interaction of any of these forces. Such alteration can affect living marine resources through changes in physical habitat, water and sediment chemistry, or the structure and function of biological communities. Among the environmental factors that limit or augment stocks are temperature, salinity, oxygen, depth, light, turbulence, currents, bottom topography, ice cover, dissolved and suspended materials, nutrients, and prey abundance, density and distribution. Temporal and spatial distribution of these factors influence their impact on stocks, but few are subject to change by man. Each fish species has its own range of limiting factors; these interact and affect survival in complex ways, usually one being more critical than others. Water pressure, light, temperature, oxygen, and nutrient elements all vary with depth, and each is vital to life in the water. Generally, other features of the water column, such as nitrogen, carbon dioxide, pH, density, and salinity, vary so little with depth that living things are not affected directly although slight variations are important for physical reasons. Currents and upwelling carry heat, nutrients, food, eggs and larvae, and the plants and animals themselves (Royce, 1972). Species thus seek the depths, currents, and substrates most favorable to their survival. Physical conditions of sediments affect species composition of the benthos. Environmental factors combine in the Bering Sea to make it among the most productive ocean habitats in the world.

9.8.1. **Description of Habitat Types.** The Bering Sea covers a flat, relatively featureless shelf whose southern boundary extends from near Unimak Pass to Cape Navarin, and from a deepwater basin bounded by the shelf and the Aleutian Island Arc. The Aleutian Island Arc contains a narrow shelf that drops off rapidly to the Bering Sea on the north and the North Pacific Ocean to the south. The oceanography of this region has been summarized by Schumacher (1984).

The waters of the Bering Sea are partitioned during the summer by transition zones which separate four hydrographic domains (Figure 9.1). The hydrographic domains are distinguished by bottom depth and seasonal changes in their vertical density structure. During the winter the structure is absent or much less apparent under the ice. Beginning in the nearshore area, the coastal domain overlays waters depths less than 50 m in depth that do not stratify seasonally due to tidal mixing. The inner front, a zone of transition, separates the coastal domain from the middle shelf domain. In the middle shelf domain, over bottom depths of 50 to 100 m, seasonal stratification sets up during the ice-free season, and warmer, less saline waters overlie colder and more saline bottom waters. This stratification persists until broken down by winter cooling and storms. A broad transition zone, called the middle front, separates the middle shelf zone from the outer shelf domain. This latter domain, in water depths from 100 to 170 m, is characterized by well-mixed upper and lower layers separated by a complex intermediate layer containing fine density structure. In general, the outer shelf waters intrude shoreward near the bottom, while middle shelf waters spread seaward above them. Beyond the outer shelf domain, the shelf break front separates the shelf waters from the oceanic domain, with its more saline, less aerobic waters overlying the Bering Sea slope and deep basin.

Circulation in the Bering Sea (Figure 9.2) is generally sluggish and dominated by tidal forces. Nearshore coastal currents from the Gulf of Alaska shelf flow into the Bering Sea through Unimak Pass and then apparently continue northeastward along the Alaska Peninsula. Within Bristol Bay, the flow becomes counterclockwise and follows the 50 m depth contour toward Nunivak Island. In the middle shelf domain (water depths from 50 - 100 m), currents are weak and variable, responding temporarily as wind-driven pulses. In the outer shelf domain, a mean northwestward flow exists along the shelf edge and upper slope following depth contours.

Habitat can also be partitioned by fish species according to its life history stage and depth of occurrence in the water column. Many of the commercial species of fish lay eggs which are either pelagic fish themselves or hatch out as pelagic larvae. These weakly swimming larval stages are distributed according to their own buoyancy, vertical swimming abilities, and the currents, mixing, or water stratification on their nursery grounds. Generally, the egg and larval stages occupy the upper mixed layer of the water column, often at or near the sea surface, until they grow and develop into more actively swimming juveniles that are able to seek a preferred depth or rearing habitat. Adults of these species are typically demersal or benthic, but some of the roundfish may form schools over a wide depth-range in the water column.

With respect to the physiographic regimes and hydrographic domains of the Bering Sea, many species cross boundaries during seasonal and spawning migrations. Shelf dwellers, such as yellowfin sole and Pacific halibut spawn in deep water 275-410 m (Garrison and Miller, 1982), while walleye pollock may leave the near-bottom depths to form mid-water spawning shoals. Other species also make similar off-on shelf migrations for spawning and feeding. Adult sablefish and Pacific ocean perch live principally on the continental slope at water depths greater than 200 m but are known to make large daily vertical movements within the water column for feeding.

9.8.2 **Habitat requirements.** This section describes the particular habitat requirements of the different species and their life stages in the Bering Sea. The information was drawn from the following sources: Andriyashbev (1954), Bakkala and Smith (1978), Carlson and Haight (1976), Carlson and Straty (1981), Garrison and Miller (1982), Gusey (1979), Hart (1973), Hood and Calder (1981), Lewbel (1983), Morris (1981), National Marine Fisheries Service (1979, 1980), Major and Shippen (1970), Paraketsov (1963), Pereyra et al (1976), and Wolotira (1977). See FMP sections 9.1, 9.2, and 9.5 for brief general descriptions of life history features, stock units, and ecological relationships.

9.8.2.1 **Walleye pollock** is the most abundant species on the continental shelf representing 20-50% of the total standing stock of demersal fishes. Pollock are found throughout the water column from shallow to deep water. Massive schools occur on the outer shelf and upper slope from the surface to 500 m; they are more common in depths less than 100 m. Their distribution is influenced by temperature. In the Eastern Bering Sea, walleye pollock undergo extensive seasonal migrations associated with feeding and reproduction. Overwintering takes place along the outer shelf and upper slope at 150-300 m, where bottom temperatures are relatively warmer. As temperatures on the shelf become warmer in spring, walleye pollock move to shallower waters (90-140 m) where spawning takes place. They first reproduce at the age of three or four years. Spawning occurs from March through July along the outer shelf, with major spawning concentrations occurring between the Pribilof Islands and Unimak Island. Each female produces approximately 60,000-400,000 pelagic eggs, which are abundant in waters shallower than 100 m. Walleye pollock eggs hatch in two to three weeks, depending on temperature; larvae remain in surface waters until attaining a length of 35-50 mm, then begin a demersal existence. By the end of the first year, juveniles are abundant on the shelf at the 90-110 m depth. Larval pollock begin feeding on copepod eggs and nauplii; as they grow, they feed successively on larger prey such as small copepods. Diets of adult pollock consist mainly of copepods, euphausiids, and fish (a majority of fish eaten are juvenile pollock). Walleye pollock constitute a major part of the diets of northern fur seals and other marine mammals in the Bering Sea, and are important as prey to seabirds and other fish species.

9.8.2.2 **Pacific cod.** This species occurs in shallower waters than walleye pollock, being generally common at depths of 80-260 m. In the Bering Sea, Pacific cod schools are most abundant on the shelf and upper slope. They undergo short seasonal migrations between the continental slope and shelf, but the timing of migrations is poorly understood. Spawning takes place from January to May, but exact timing and areas of spawning are not known. Females produce from 200,000 to 5,700,000 eggs which are benthic and initially slightly adhesive. The eggs hatch within 10-20 days and larvae are distributed at depths from 25-150 m, with the largest numbers at 75-100 m. Adults are mostly benthic and feed primarily on benthic epifauna, but they also eat planktonic crustaceans and fish. Pacific cod are utilized as food by northern fur seals, halibut, belugas, and sperm whales.

9.8.2.3 **Yellowfin sole.** The eastern Bering Sea contains the largest single population of this flatfish, which occurs on the shelf at depths from 5-360 m. Yellowfin sole undergo complex seasonal movements (both vertical and horizontal) that are not fully understood. During winter, adults congregate in large dense schools on the outer shelf and upper slope from 100-270 m. In spring, fish begin moving into shallower waters, and by summer the main body of the stock is found on the inner shelf at depths of less than 100 m where feeding and spawning takes place. Winter causes fish to migrate back to deeper waters. Distribution and movements of yellowfin sole are associated with environmental factors including temperature, salinity, and bottom sediment type. Adult yellowfin sole are not confined to the bottom, but make periodic vertical movements up into the water column. Spawning takes place predominantly in June and July on the inner shelf with females releasing from one to three million pelagic eggs, which accumulate in central areas of well-developed gyres. The larvae are pelagic for four to five months before undergoing metamorphosis; at lengths of about 17 mm the juvenile sole settle to the bottom along the inner shelf. As the juveniles grow they apparently move gradually into deeper water. Their principal prey include benthic infauna and epifauna, although they also eat euphausiids, copepods and fish. Important predators on yellowfin sole include Pacific halibut and northern fur seals.

9.8.2.4 **Greenland turbot.** Large concentrations of greenland turbot are found in the eastern Bering Sea and Navarin Basin in a depth range of about 70-670 m. Seasonal movements by greenland turbot are complex and not fully understood. They are generally found at shallower depths in the summer than in winter. Spawning occurs from October to December in waters greater than 100 m in depth; the eggs are apparently bathypelagic, developing in deep water. After hatching, the larvae are pelagic and found in the 30-130 m depth range until they reach a length of about 80 mm when they transform and become demersal. Little else is known about the life history. Greenland turbot feed on a variety of foods including pelagic, mid-water, and demersal fishes and crustaceans.

9.8.2.5 **Other flatfishes:** these include rock sole, flathead sole, arrowtooth flounder, rex sole, butter sole, longhead dab, Dover sole, starry flounder, Alaska plaice, and longnose plaice.

Rock sole are most abundant in the southeastern region of the Bering Sea where they occupy areas of the shelf down to 300 m. Seasonal movements are not well-known. Spawning takes place from March to June at depths near 100 m. Eggs are adhesive and demersal, sinking to bottom; larvae are pelagic. Adults prey on benthic invertebrates, and occasionally on fish. Predators include fish and marine mammals.

Flathead sole are most abundant in the eastern portion of the Bering Sea. They range in depth from the surface to 550 m. Seasonal distributions consist of concentrations overwintering in depths of 70-400 m on the outer shelf which then migrate to shallower waters (20-180 m) in the spring. Reproduction takes place during February to May within the shelf boundaries; eggs and larvae are pelagic and become widely distributed. The adults prey upon benthic crustaceans and echinoderms, switching to planktonic crustaceans and arrow worms while in shallow waters. Predators on flathead sole are not well-known, but are thought to be Pacific halibut and marine mammals.

Arrowtooth flounder are most abundant on the continental slope of the southeastern, central, and northwestern Bering Sea at depths of 200-500 m. Arrowtooth flounder move seasonally from the 300-500 m depth range in the winter to the 200-400 m depth range in the summer, apparently associated with water temperatures. Adults are thought to spawn from December to February, releasing up to 500,000 bathypelagic eggs. Hatched larvae remain in shallow nearshore waters over the shelf for several months; then they settle to the bottom. Juveniles gradually move into deeper waters as they grow. Major foods include crustaceans and fish. Predators on arrowtooth flounder are thought to be Pacific halibut and marine mammals.

9.8.2.6 **Pacific ocean perch.** The species is common in and along canyons and depressions on the upper continental slope. Two main stocks are thought to be present in the Bering Sea: an Aleutian stock, which is probably the most abundant; and an eastern slope stock along the continental slope in the eastern Bering Sea with large concentrations from the Pribilof Islands to Unimak Island. The densest concentrations occur from January to May, during spawning, west of the Pribilofs at depths of 340-420 m. During this period, the species undergoes daily vertical migrations, probably for feeding. Rockfishes give birth to live young. Because Pacific ocean perch inhabit such deep waters, tag and recapture studies are virtually impossible. Any statements about their migration patterns are therefore speculation.

Pacific ocean perch probably mate during winter (October - February) and young are born in spring (March - June). Larvae are five to eight mm at birth and live a planktonic existence for an undetermined period of time. By the end of their first year, the young fish begin a demersal existence at depths of 125-150 m. Pinnacles, rocky or gravel areas are used as nursery sites; here the juveniles remain, gradually moving deeper as they mature. The juveniles (ages one to five) feed mainly on copepods and euphausiids; adults on euphasiids, copepods, fish and squid. Pacific halibut are the main predators on Pacific ocean perch in the Bering Sea.

9.8.2.7 **Other rockfishes.** Rougheye rockfish, dusky rockfish, northern rockfish, shortspine thornyhead, shortraker rockfish, dark blotched rockfish, yelloweye rockfish, blue rockfish. These species are mostly demersal and distributed from the surface to very deep waters. Little is known about the biology of Bering Sea rockfishes other than Pacific ocean perch (see section 9.8.2.6 above).

9.8.2.8 **Sablefish.** This species occupies a wide depth range of 0-1200 m and is most abundant on the outer continental shelf and continental slope (100-600 m) where 15 to 20 percent of the total species biomass is located. Sablefish undertake extensive migrations between different areas in the North Pacific; more localized cross-shelf migrations have also been observed. Sablefish make daily vertical movements associated with feeding; fish are found higher in the water column during the day and nearer the bottom at night. Sablefish spawn during winter (February) at depths of around 550 m, where females release up to 1,000,000 pelagic eggs which rise toward the surface as they develop and hatch. Later-stage larvae are found near the surface. Little is known of egg or larval development, although one-year-old juveniles appear annually in shallow coastal waters. As pelagic juveniles mature, they move into deeper waters and become demersal. Sablefish feed on a wide variety of prey, both pelagic and benthic, depending on location, season, and age of fish. The prey include squid, capelin, pollock, and euphausiids, shrimp, pleuronectid species, cottids, and benthic invertebrates. Predators on sablefish include Pacific halibut, ling cod, and sea lions.

9.8.2.9 **Atka mackerel.** This species occurs in the Bering Sea from the Aleutian Islands to Cape Navarin. It is demersal during spawning, but is generally encountered in the upper water layers. Atka mackerel spawn from June to September in coastal areas with stony or rocky bottoms. The eggs are benthic and are deposited in large masses on stones or in cracks among rocks. Hatched larvae are found at depths of 2-30 m and move to the surface at night. The larvae are widely dispersed for distances of up to 200-500 miles from shore. Adults feed largely on euphausiids. Predators on Atka mackerel are marine mammals and the larger pelagic fishes.

9.8.2.10 **Squid.** Several species of squid inhabit Bering Sea waters, wide ranging in distribution. The exact nature and size of the resource is poorly defined, but is generally agreed to be large and mobile. They live at mid-water and near surface depths. Spawning, for some species, may extend from spring to fall; sexual maturity may be reached in two years or less. Fertilization is internal; the fertilized eggs are released enmeshed in a gelatinous material. The number of eggs spawned per individual is low compared to groundfish. Predators on squid are marine mammals and pelagic fishes. Illex vulgaris, a common Bering Sea squid, is a typical catch species, ranging in mantle size from 22-35 cm in length. Much of the present squid catch is incidental to catches of demersal fisheries.

9.8.2.11 **Pacific halibut.** The distribution is widespread on the shelf and slope to depths of up to 700 m. They undertake seasonal migrations to shallow spring feeding areas, and to deeper waters (250-550 m) in the fall, where they spawn and remain in the winter. Seasonal movements can extend as far as 800 km. Spawning takes place from November through February, and females released up to two million pelagic eggs. Larvae are also pelagic until reaching a length of about ten cm after about six months; at that time they settle to the bottom to begin a benthic existence. During the pelagic life stage, eggs and larvae may be transported several hundred km by currents. Pacific halibut are long-lived and may reach ages in excess of 40 years. They are opportunistic feeders, consuming a variety of prey, which varies with age and area. Juvenile fish feed mainly on crustaceans, whereas older fish eat mostly other fish, particularly flounders. Predators of Pacific halibut are poorly known.

9.8.3 Habitat areas of particular concern. As outlined in the previous section, the groundfish resources of the Bering Sea are abundant and widely distributed in both space and time. With the possible exception of the ice-covered surface layer of the shelf during winter, there is not an area, water depth, or time of year when one or several species of commercial importance are not present at some life stage. It is difficult therefore, to designate particular habitats that can be spatially and temporally defined as holding substantially more important resource values than other areas.

Adults of most of the commercially important groundfish species are known to form dense aggregations on feeding or spawning grounds at certain seasons. Most often these concentrations are found on or inside of the shelf edge in spring and early summer when and where suitable environmental conditions have formed. However, these areas shift in size and location from year to year, presumably due to a combination of environmental and population variables that are not yet well understood. For example, feeding pollock concentrations have been found to be primarily located in outer shelf waters in years when the bottom water of the middle shelf domain remained cold, but extended onto the middle shelf in warm years (Lynde, 1984).

Eggs and larvae of the groundfish species are usually more widely distributed spatially than the adults, but may be confined to a specific range of water depths. Some species such as walleye pollock lay buoyant eggs that float to the sea surface; sablefish larvae move to the surface layer during development; other species such as Atka mackerel and rock sole lay demersal eggs that sink or adhere to the bottom.

In a general way, the following habitats of the Bering Sea and Aleutians can be described as particularly rich in groundfish:

- The shelf edge from Unimak Pass northwest toward the Pribilof Islands contains abundant schools of walleye pollock and Pacific cod.

- The seabed of the middle shelf of outer Bristol Bay contains the densest spawning and feeding aggregations of yellowfin sole.

- Submarine canyons along the continental slope of the Bering Sea and Aleutian Islands harbor the densest concentrations of Pacific ocean perch and other rockfish species.

- Atka mackerel spawning occurs on certain restricted shelf areas with suitable (rocky) bottom characteristics, and may be particularly concentrated in the western Aleutians, such as the strait between Atka and Amlia Islands.

- Pacific herring overwinter in dense schools inside the shelf edge in the central Bering Sea. These schools are often discrete, being tens of meters thick and covering many square kilometers in area.

Significant increases in knowledge of the habitat requirements of the groundfish species are yet to be made. With this additional understanding, it may be possible to provide a finer definition of habitat areas of particular concern and a better ability to manage single and multispecies fishery resources.

9.8.4 **Habitat threats.** This section discusses the potential sources of pollution and habitat degradation that could affect groundfish populations in the Bering Sea and Aleutian Islands area. At present, there are no indications that any of these potential threats to the habitat have had any measurable effect on the existing habitats or stocks of groundfish, though there have been localized effects. The purpose of this discussion is to create awareness of potential problems or cumulative impacts that may occur in the future and that could be avoided.

The present primary human use of the Bering Sea/Aleutian Island area is commercial fishing. While the establishment of other activities could create user conflicts, pollution, and habitat deterioration, it is the collective opinion of NMFS and the Council that the status of the habitat in this management area is generally unimpacted by other human activities at this time. If there should be a large oil or gas discovery or surge in other development activities it may be appropriate to make a subsequent review of the habitat's status.

9.8.4.1. **Oil and Gas Development.** Oil and gas related activities in the Bering Sea and Aleutian area could cause pollution of habitats, loss of resources, and use conflicts. Preemption of fishing grounds because of the siting of offshore drilling rigs and platforms, loading platforms, pipelines, or an oil spill may result in the dislocation of fishing grounds, possibly a reduction in habitat quality or quantity. Some structures could increase hard substrate habitat and result in an increase in populations of some species of rockfish. Schooling fish may also concentrate near some structures. Habitat decreases would result only from physical alteration of the habitat by construction activities, losses of productivity or resident biota, or chemical degradation from pollutants.

<u>Pollution Risks.</u> Oil spills are the most serious source of pollution. Offshore oil and gas development will inevitably result in some oil entering the environment. At some level, this oil can affect habitats and fish populations and has the potential to be damaging. Although many factors determine the degree and duration of damage from a spill, the most important variables are the size of the spill, the duration of the spill, and the time and geographic location of the spill. Oil is toxic to all marine organisms at some concentration. Certain species are more sensitive than others. In general, the early life stages (eggs and larvae) are most sensitive; juveniles and adults are less sensitive (Rice, et al, 1984).

Habitats most sensitive to oil pollution are those with the lowest physical energy because once oiled, these areas are the slowest to repurify. Examples of low energy environments include tidal marshes and seafloor sediments. Rocky coasts and ocean surface waters are higher energy environments where physical processes will more rapidly remove or actively weather spilled oil.

A major oil spill (i.e., 50,000 bbls) would produce a surface slick covering up to several hundred square kilometers of surface area. Oil would generally be at toxic levels within this slick. Beneath and surrounding the surface slick, there would be oil-contaminated waters with lethal to sub-lethal concentrations depending on the time and distance from the surface slick. Mixing and current dispersal would act to reduce the oil concentrations with depth and distance. If the oil spill trajectory moves toward land, habitats and species could be severely affected by the loading of toxic quantities of oil into a bounded area of the nearshore environment. In the nearshore waters (i.e. Inner Domain, or Middle Domain in winter) oil could be mixed throughout the water column and contaminate the seabed sediments. Suspended sediment will also act to carry oil to the seabed. During recovery, a year class of a commercially important species of fish or shellfish could be reduced in numbers, and any fishery dependent on it would be reduced.

Toxic fractions of oil mixed to depth and under the surface slick would cause mortalities and sublethal effects to individuals and populations. However, the area contaminated would appear negligible in relation to the overall size of the area inhabited by commercial groundfish in the Bering Sea. For example, Thorsteinson and Thorsteinson (1982) calculated that a 50,000 barrel spill in the St. George Basin would impact less than 0.002 percent of the total size of this area. As a result, oil spills at sea are believed to be transitory and minor in effect on fish populations overall. But even though concentrations of oil may be sufficiently diluted not to be physically damaging to marine organisms or their consumers, it still may be detected by them, and alter certain of their behavior patterns. For instance, some animals may alter their migration routes as an avoidance response. Other exceptions are where the spill reaches nearshore areas with productive nursery grounds or areas containing high densities of fish larvae in surface waters. An oil spill at an especially important habitat (e.g., a gyre where larvae are concentrated) could result in disproportionately high losses of the resource compared to other areas.

Other sources of potential habitat degradation and pollution from oil and gas activities include the disposal of drilling muds and cuttings to the water and seabed, disposal of drilling fluids and produced waters in the water column, and dredging materials from pipeline laying or facilities construction. These materials may contain heavy metals or other chemical compounds that will be released to the environment, but in general, the quantities are such that only local impacts can be expected to occur. Again, these activities may be of concern if they occurred in habitats of special biological importance to a resource.

Interference by Seismic Vessel Operations. Seismic vessels operate in the Bering Sea/Aleutian area for oil and gas exploration purposes. The potential exists for interference between commercial fishing vessels and seismic vessels if both are operating their gear in an area at the same time. The effect of seismic noises on groundfish is being studied off the coast of California, since concern has been expressed by fishermen that the seismic pulse has the effect of dispersing schools of fish and making them difficult to catch. Results of these studies are not yet available. There have not been many complaints by fishermen about seismic activities interfering with harvest in the Bering Sea area. If a significant problem were to develop, it might be necessary to regulate seismic operations around fishery areas.

9.8.4.2 **Coastal development and filling.** Minimal developmental pressure has occurred in the coastal habitat of the Bering Sea and Aleutian area. An extension of the runway into water of approximately 50-foot depth has been permitted at Unalaska but as yet is not constructed. Other projects include occasional modifications and expansions of harbors and breakwaters.

9.8.4.3 **Marine mining.** Of the various types of mining activities which could occur, gravel and gold mining have probably the greatest potential for development. Gravel is needed for almost all construction projects and is relatively unavailable from upland locations. Dredging for gold has been attempted at various sites along the Aleutians and off the coast near Nome. As yet no longterm or extensive dredging operations have resulted.

9.8.4.4 **Derelict fragments of fishing gear and general litter.** The types of fishing gear used in the groundfish fishery are trawls, and longlines - with trawls being by far the commonest. The pot fisheries for Alaska king crab and tanner crab also result in a high quantity of lost pots. Deliberate discards and accidental losses of gear can affect the groundfish and other species such as salmon, marine mammals, marine birds, and crab. Heavy polyethylene and polypropylene netting from trawl gear comprised about 80 percent of the observed litter at Amchitka Island in surveys by Merrell (1984). Derelict trawl web probably has its main impact in terms of entanglement of marine mammals such as seals, seal lions, and fur seals. While drifting at sea, the trawl webbing floats at the surface and is probably not a threat to groundfish. The survey data collected by Merrell has shown that most of the observed litter is in small and damaged pieces of trawl webbing which were probably discarded deliberately at the time repairs were made to the trawls. A significant decline (37%) in the amount of debris was observed between 1974 and 1982, which may be an indication of reduced fishing effort or greater control on the part of fishermen in discarding debris. There are no specific estimates of the amounts of trawl-related gear being lost in the Bering Sea/Aleutian management area. There are estimates of the numbers of derelict crab pots, many of which may still be fishing and entrapping Pacific halibut and other groundfish (High, 1976 and 1979).

9.8.4.5 **Organic enrichment.** Organic enrichment may result from natural input of carbon (very high rates of primary production) or from man-induced changes such as oils or discharge from fishing vessels and processing plants. Fishing vessels and processing plants have three principal reasons for discharging organic material:

(a) dumping of prohibited species (salmon, crab, herring, and halibut) which are inadvertently caught;
(b) dumping of undesirable or untargeted catches due to lack of market, size of the fish, damaged fish, limitations in individual vessel quotas (trip limits), or individual vessel limitations such as no fish meal plant onboard;
(c) discharge of waste product and viscera from onshore and offshore processing plants. (Also varies depending on presence of fish meal plant).

Low temperatures reduce metabolic rates of microorganisms and the oxidation of carbon. Depressions containing very cold Arctic water, therefore, are conducive to development of anoxic conditions if excessive organic enrichment occurs over a short time period and circulation is poor. In the case of poor bottom circulation and absence of scavengers to consume the material, organic material may take a long time to decompose and could become a source of contamination for the spread of bacterial and viral diseases. Development of a layer of anoxic bottom water could also adversely affect benthic organisms (Karinen, Auke Bay Laboratory, personal communication).

No real measure of the amount of discard based on reasons (b) or (c) can be made. There are statistics kept of (a), but even if they were summarized, it would be difficult to determine what impact the discard is having on the environment. Marine mammals and birds are frequently seen flocking to an area at times of discard and consuming considerable quantities of the fish or viscera; however, some portion of the discard is probably settling to the bottom. Areas of minimal circulation and flushing in the Bering Sea may warrant identification and periodic checking of the oxygen level to determine if groundfish stocks are being negatively affected. Two areas of potential concern are (1) the relatively deep canyon along the shelf edge in the midddle portion of the Bering Sea and (2) the middle-domain in Bristol Bay near the Alaskan Peninsula which has several basins that are occasionally filled with very cold arctic water following periods of minimal storm activity in early spring.

Requiring full utilization of allowable catch would reduce the occurence of discarded catches, but would create additional economic and management concerns. The relationship between amount and impact of present levels of offshore discards and incidence of diseases in demersal fish may warrant special concerns at this time. The location of any new shoreside processors should be examined for ability to assimilate organic waste.

9.8.4.6 **Ocean discharge and dumping.** At this time there are no significant uses of the Bering Sea/Aleutian area for ocean disposals such as sewage sludge, industrial waste products, dredged materials, or radioactive waste.

9.8.4.7 **Benthic habitat damage by bottom gear.** Trawling with bottom trawls is the predominant method of fishing for groundfish in the Bering Sea/Aleutian management area with the biggest efforts being directed toward yellowfin sole and cod, and pollock by the Japanese fishermen. Midwater trawls are used to some extent and they occasionally contact the bottom, but in general do not drag through the mud. The bottom type is primarily flat, even, and composed of sand and mud, considered good substrate for trawling. Even though there are no direct observations of trawl door effects in the Bering Sea, there have been experiments at the marine laboratory at Aberdeen, Scotland. In general, these experiments showed the impacts from trawl doors to be minimal (West, NWAFC, personal communication). There have also been observations in other areas with other gear. At one time, the NWAFC looked at the result of a clam dredge passing over the ocean floor with a TV video camera. The biggest disruption on the bottom came from the impact of the dredge which created a two to three foot wide ditch or trench; the effect of the foot rope of the trawl was minor. In the video it was observed that crabs and starfish had converged on the dredge track within fifteen minutes. The sediment disturbed by the dredge had settled within thirty minutes, with the only visible trace being the ditches dug by the dredge, and crab and starfish concentrations along the ditches (Wathne, NWAFC, personal communication). A less visible impact would be disturbance of demersal eggs, such as rock sole and Pacific cod, by the passage of trawls.

9.8.4.8 **Contamination by heavy metals.** Accumulation of heavy metals in fish is an indicator of habitat deterioration, which would, in turn, affect marketability of the fish. The FDA's safety limit for mercury is presently 1.0 ppm of methyl mercury or about 1.1 ppm of Hg. In Hall, et al (1976) a sample of sablefish caught in the Bering Sea and in the vicinity of Kodiak Island contained very low levels of mercury (0.02 - 0.11, $\bar{x}$ 0.04 ppm).

9.8.4.9 **Environmental stress indication.** Four demersal fish species in the Bering Sea show significant incidences (1 to >20 percent) of tumors and microbial diseases (McCain et al. 1979). The species with abnormalities were Pacific cod with pseudobranchial tumors and skin lesions, walleye pollock with pseudobranchial tumors, yellowfin sole with lymphocystis, and rock sole with epidermal papillomas. Frequencies for these diseases ranged from 1.4 percent for papillomas in rock sole to 8.7 percent for tumors in Pacific cod. Lymphocystis in yellowfin sole averaged 2.8 percent, skin ulcers in cod 1.6 percent and tumors in walleye pollock 1.7 percent. Incidence of diseases varied considerably with location. The area adjacent and north of Unimak Island had the highest (10 to >20 percent) incidences of the virus-caused lymphocystis in yellowfin sole; more than 20 percent incidence of papillomas in rock sole and high incidences (10 to 20 percent) of tumors in Pacific cod and walleye pollock (10 to 15 percent). Other areas of high incidence (10 to >20 percent of tumors in Pacific cod occurred along the shelf edge in the central Bering Sea (56 degrees North, 170 degrees West and 58 degrees North, 173 degrees West). The reasons for these distributions of diseases are not clear since several of these species are migratory. (See section 9.8.4.5 for related material.)

9.8.5 **Habitat protection: existing programs.** This section describes (a) general legislative programs, portions of which are particularly directed or related to the protection, maintenance, or restoration of the habitat of living marine resources; and (b) specific actions taken within the Bering Sea/Aleutian Island area for the same purpose.

9.8.5.1 **Federal legislative programs and responsibilities related to habitat.** The Department of Commerce, through NOAA, is responsible for, or involved in, protecting living marine resources and their habitats under a number of Congressional authorities that call for varying degrees of interagency participation, consultation, or review. Those having direct effect on Council responsibilities are identified with an asterisk. A potential for further Council participation exists wherever Federal - level review is required or encouraged. In some cases, State agencies may share the Federal responsibility. (See Sections 9.8.3 and 9.8.5.2 for specific application to groundfish.)

* (a) Magnuson Fishery Conservation and Management Act (Magnuson Act). This Act provides for the conservation and management of U.S. fishery resources within the 200-mile fishery conservation zone, and is the primary authority for Council action. Conservation and management is defined as referring to "all of the rules, regulations, conditions, methods, and other measures which are required to rebuild, restore, or maintain, and which are useful in rebuilding, restoring, or maintaining, any fishery resource and the marine environment, and which are designed to assure that... irreversible or long-term adverse effects on fishery resources and the marine environment are avoided." Fishery resource is defined to include habitat of fish. The North Pacific Council is charged with developing FMPs, FMP amendments, and regulations for the fisheries needing conservation and management within its geographical area of authority. FMPs are developed in consideration of habitat-related problems and other factors relating to resource productivity. After approval of FMPs or FMP amendments, NMFS is charged with their implementation.

(b) Fish and Wildlife Coordination Act of 1958 (FWCA). The FWCA provides the primary expression of Federal policy for fish and wildlife habitat. It requires interagency consultation to assure that fish and wildlife are given equal consideration when a Federal or Federally-authorized project is proposed which controls, modifies, or develops the Nation's waters. For example, NMFS is a consulting resource agency in processing Department of the Army permits for dredge and fill and construction projects in navigable waters, Environmental Protection Agency (EPA) ocean dumping permits, Federal Energy Regulatory Commission hydroelectric power project proposals, and Department of the Interior (DOI) Outer Continental Shelf (OCS) mineral leasing activities, among others.

* (c) National Environmental Policy Act of 1969 (NEPA). NEPA requires that the effects of Federal activities on the environment be assessed. Its purpose is to insure that Federal

officials weigh and give appropriate consideration to environmental values in policy formulation, decisionmaking and administrative actions, and that the public is provided adequate opportunity to review and comment on the major Federal actions. NEPA requires preparation of an Environmental Impact Statement (EIS) for major Federal actions that significantly affect the quality of the human environment, and consultation with the agencies having legal jurisdiction or expertise for the affected resources. NMFS reviews EISs and provides recommendations to mitigate any expected impacts to living marine resources and habitats. An EIS or environmental assessment for a finding of no significant impact is prepared for FMPs and their amendments.

(d) Clean Water Act (CWA). The purpose of the CWA, which amends the Federal Water Pollution Control Act, is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters; to eliminate the discharge of pollutants into navigable waters; and to prohibit the discharge of toxic pollutants in toxic amounts. Discharge of oil or hazardous substances into or upon navigable waters, contiguous zone and ocean is prohibited. NMFS reviews and comments on Section 404 permits for deposition of fill or dredged materials into U.S. waters, and on EPA National Pollutant Discharge Elimination System permits for point source discharges.

(e) River and Harbor Act of 1899. Section 10 of this Act prohibits the unauthorized obstruction or alteration of any navigable water of the United States, the excavation from or deposition of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such water. Authority was later extended to artificial islands and fixed structures located on the Outer Continental Shelf. The Act authorizes the Department of the Army to regulate all construction and dredge and fill activities in navigable waters to mean high water shoreline. NMFS reviews and comments on Public Notices the Corps of Engineers circulates for proposed projects.

* (f) Endangered Species Act of 1973 (ESA). The ESA provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by DOI (terrestrial, freshwater, and some marine species such as walrus) and DOC (marine fish, and some marine mammals including the great whales). Federal actions that may affect an endangered or threatened species are resolved by a consultation process between the project agency and DOC or DOI, as appropriate. For actions related to FMPs, NMFS provides biological assessments and Section 7 consultations if the Federal action may affect endangered or threatened species or cause destruction or adverse modification of any designated critical habitat.

* (g) Coastal Zone Management Act of 1972 (CZMA). The principal objective of the CZMA is to encourage and assist States in developing coastal zone management programs, to coordinate State activities, and to safeguard the regional and national interests in the coastal zone. Section 307(c) requires that any Federal activity

directly affecting the coastal zone of a State be consistent with that State's approved coastal zone management program to the maximum extent practicable. Under present policy, FMPs undergo consistency review. Alaska's coastal zone program contains a section on Resources and Habitats. Following a January 1984 U.S. Supreme Court ruling, the sale of OCS oil and gas leases no longer requires a consistency review; such a review is triggered at the exploratory drilling stage. (See Section 10.3.)

* (h) Marine Protection, Research and Sanctuaries Act (MPRSA). Title I of the MPRSA establishes a system to regulate dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect "human health, welfare or amenities or the marine environment, ecological systems, or economic potentialities." NMFS may provide comments to EPA on proposed sites of ocean dumping if the marine environment or ecological systems may be adversely affected. Title III of the MPRSA authorizes the Secretary of Commerce (NOAA) to designate as marine sanctuaries areas of the marine environment that have been identified as having special national significance due to their resource or human-use values. The Marine Sanctuaries Amendments of 1984 amend this Title to include, as consultative agencies in determining whether the proposal meets the sanctuary designation standards, the Councils affected by the proposed designation. The Amendments also provide the Council affected with the opportunity to prepare draft regulations, consistent with the Magnuson Act national standards, for fishing within the FCZ as it may deem necessary to implement a proposed designation.

(i) Outer Continental Shelf Lands Act of 1953, as amended (OCSLA). The OCSLA authorizes the Department of Interior's Minerals Management Service (MMS) to lease lands seaward of state marine boundaries, design and oversee environmental studies, prepare environmental impact statements, enforce special lease stipulations, and issue pipeline rights-of-way. It specifies that no exploratory drilling permit can be issued unless MMS determines that "such exploration will not be unduly harmful to aquatic life in the area, result in pollution, create hazardous or unsafe conditions, unreasonably interfere with other uses of the area, or disturb any site, structure or object of historical or archaeological significance." Drilling and production discharges related to OCS exploration and development are subject to EPA NPDES permit regulations under the CWA. Sharing responsibility for the protection of fish and wildlife resources and their habitats, NOAA/NMFS, FWS, EPA and the States act in an advisory capacity in the formulation of OCS leasing stipulations that MMS develops for conditions or resources that are believed to warrant special regulation or protection. Some of these stipulations address protection of biological resources and their habitats. Interagency Regional Biological Task Forces and Technical Working Groups have been established by MMS to offer advice on various aspects of leasing, transport, and environmental studies. NMFS is represented on both groups in Alaska.

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* (j) National Fishing Enhancement Act of 1984. Title II of this Act authorizes the Secretary of Commerce (NOAA) to develop and publish a National Artificial Reef Plan in consultation with specified public agencies, including the Councils, for the purpose of enhancing fishery resources. Permits for the siting, construction, and monitoring of such reefs are to be issued by the Deaprtment of the Army under Section 10 of the River and Harbor Act, Section 404 of the Clean Water Act, or Section 4(e) of the Outer Continental Shelf Lands Act, in consultation with appropriate Federal agencies, States, local governments and other interested parties. NMFS will be included in this consultation process.

(k) Northwest Power Act of 1980 (NPA). The NPA includes extensive and unprecedented fish and wildlife provisions designed to assure equitable treatment of fish and wildlife, particularly anadromous fish, in making decisions about hydroelectric projects. Under the NPA, a detailed Fish and Wildlife Program has been established to protect, mitigate, and enhance fish and wildlife in the Columbia River Basin. In addition, general fish and wildlife criteria for hydroelectric development throughout the region have been established in the Regional Energy Plan developed under the Act. NMFS has a statutory role in the development of the Program and the Plan and encourages their implementation by Federal agencies such as the Federal Energy Regulatory Commmission, the Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration.

(l) Alaska National Interest Lands Conservation Act of 1980 (ANILCA). The purpose of this Act is to provide for the designation and conservation of certain public lands in Alaska. The Department of Agriculture Forest Service has authority to manage surface resources on National Forest Lands in Alaska. Under Title V of this Act, any regulations for this purpose must take into consideration existing laws and regulations to maintain the habitats, to the maximum extent feasible, of anadromous fish and other foodfish, and to maintain the present and continued productivity of such habitat when they are affected by mining activities. For example, mining operations in the vicinity of the Quartz Hill area in the Tongass National Forest must be conducted in accordance with an approved operations plan developed in consultation with NMFS; consultation continues through the monitoring and altering of operations through an annual review of the operations plan. Title XII of the Act establishes an Alaska Land Use Council to advise Federal agencies, the State, local governments and Native Corporations with respect to land and resource uses in Alaska. NOAA is named as a member of this Council.

9.8.5.2 **Specific actions for the Bering Sea/Aleutian Islands Groundfish fishery.**

(a) Gear limitations that act to protect habitat or critical life stages. Section 611.16 of the foreign fishing regulations prohibit discard of fishing gear and other debris by foreign fishing vessels.

(b) Seasonal restrictions that act to protect habitat or critical life stages. Section 14.5.3 of the FMP prohibits foreign trawling year-round in the Bristol Bay Pot Sanctuary to prevent incidental catch of juvenile halibut that are known to concentrate in this area. It also restricts foreign trawling from December 1 through May 31 in the Winter Halibut Savings Area to protect winter concentrations of juvenile halibut and spawning concentrations of pollock and flounders.

(c) Other management measures that act to allow for contingencies in the condition of the stock. Sections 675.20(a)(3) and 611.93 of the Bering Sea/Aleutian Islands Groundfish regulations establish a Reserve at 15% of the TAC; on specified dates, that portion of this reserve which the NMFS Regional Director finds will be harvested by U.S. vessels during the remainder of the year will be allocated to DAH, with the rest allocated to TALFF. However, the Regional Director is also permitted to withhold reserves for conservation purposes.

(d) Recommendations to permitting agencies regarding lease sales. Recommendations have been made to permitting agencies on all past proposed lease sales on the Alaska OCS, in the interests of protecting or maintaining the marine environment. These recommendations have ranged from calling for delay or postponement of certain scheduled sales such as in Bristol Bay and Kodiak, requesting deletions of certain areas from sales, identifying need for additional environmental studies and for protective measures such as burial of pipelines, seasonal drilling limitations, and oilspill countermeasure planning. For example, in 1979, the Council unanimously requested an indefinite postponement of the St. George Basin lease sale, citing incomplete research results and a concern for the possibility of oil spills in an area of great economic and biologic importance. The comment was transmitted to the NMFS Central Office for transmittal to the Department of Interior. Recommendations are generally made in response to the "Call for Information," the Environmental Impact Statements, and the Proposed Notice of Sale for each lease sale. Exploration plans submitted by each oil company are also reviewed for their environmental protection provisions. In the future, assuming commercial discoveries of oil or gas, development EISs and plans will undergo a similar process for review and comment.

9.8.6 Habitat recommendations.

9.8.6.1 General techniques to address identified problems. The following is a list of "real time" possible actions or strategies the Council may wish to take in the future, based on concerns expressed and data presented or referenced in this FMP. Actions taken must also be consistent with the goals and objectives of the FMP. Authorities for Council participation are described in section 9.8.5.1.

(a) Non-regulatory.

- Hold hearings to gather information or opinions about specific proposed projects having a potentially adverse affect on the Bering Sea/Aleutian Island groundfish fishery.

- Write comments to regulatory agencies during project review periods to express concerns or make recommendations about issuance or denial of particular permits.

- Respond to "Calls for Information" from MMS regarding upcoming oil and gas lease areas affecting the Bering Sea/Aleutian Islands.

- Identify research needs and recommend funding for studies related to habitat issues of new or continuing concern and for which the data base is limited. Examples would include research to identify critical habitats or to determine the long-term effect of various levels and types of toxicity on marine fish and their food webs in the Bering Sea/Aleutian Islands region. Other examples: underwater TV observations of trawl impacts, and investigations as to how to modify gear to reduce these impacts.

- Establish review panels or an ad hoc task force to coordinate or screen habitat issues.

- Propose to other regulatory agencies additional restrictions on industries operating in the fisheries management area, for purposes of protecting the fisheries or habitat against loss or degradation. Examples are waste discharge restrictions for floating processors, or drilling restrictions for oil and gas exploration.

- Join as amicus in litigation brought in furtherance of critical habitat conservation, consistent with FMP goals and objectives.

(b) Regulatory. An FMP may contain only those conservation and management measures which pertain to fishing or to fishing vessels.

- Propose regulations establishing gear, timing, or area restrictions for purposes of protecting particular habitats or life stages of species in the Bering Sea/Aleutian Island groundfish fishery. An example would be the winter halibut savings area designed to protect juvenile Pacific halibut concentrations during the winter months.

- Propose regulations establishing area or timing restrictions to prevent the harvest of low-quality fish in contaminated areas, in the interests of public health and safety. An example would be that if fish taken at or near dumpsites or areas of concentrated discharge were shown to be harmful to human health or to be less valuable commercially or nutritionally, an area closure could be established.

- Propose regulations restricting disposal of fishing gear.

9.8.6.2 **Specific recommendations.** The following section summarizes Council policy regarding the habitat issues contained in the Bering Sea and Aleutian Island FMP.

(a) Recommendation re further research.

(b) Recommendations re oil activity.

1. Second offering lease sales that are scheduled at two year intervals in the Bering Sea (for example, in the St. George or Navarin Basins) should be reviewed to determine whether delays might be called for. Such delays might allow time for the oil industry to gain experience in these areas, to learn from mistakes that may be made and could avoid being repeated, and to allow the oil and fishing industries to evolve a mutual understanding and cooperative working relationship with each other. Accelerating the pace of leasing can unnecessarily compound conflicts and competition and deter their resolution. These sales are scheduled at a time of an expanding domestic fishing industry which could reach full utilization capacity in the EEZ.

2. Because the southern Bering Sea area contains the greatest abundance of harvestable groundfish species, as well as the most productive king and tanner crab grounds in the U.S. sector of the Bering Sea, oil leasing on the productive fishing areas should be examined to determine whether it should be deferred. Oil spills and fishing conflicts are paramount concerns. Damage to this productive habitat could have long-lasting consequences to the fisheries. The fishing industry desires to learn from their experiences with the oil industry in the other Bering Sea lease areas (i.e. the St. George and Navarin Basins) before oil drilling is authorized in this single most productive area of offshore Alaska.

10.0 Other Considerations which May Affect the Fishery.

10.3. **Offshore Petroleum Production.** Material here and at section 9.8.4.1 is drawn from Berg (1977); Deis et al (1983); OCSEAP Synthesis Reports on the St. George Basin (1982), the Navarin Basin (1984), and the North Aleutian Shelf (1984); Thorsteinson and Thoorsteinson (1982); and the University of Aberdeen (1978).

10.3.1 **History.** The first Federal lease sale on the Alaska offshore area was held in April 1976 in the northern Gulf of Alaska. Since then, there have been nine other lease sales. No development or production activities have taken place. The Alaska offshore area comprises 74 percent of the total area of the U.S. continental shelf. Because of its size, the Alaska OCS is divided into 3 subregions--Arctic, Bering Sea, and Gulf of Alaska. The Bering Sea/Aleutian Subregion contains five planning areas where lease sales have been held or are currently scheduled - Norton Basin, St. George Basin, Navarin Basin, North Aleutian Basin, and Shumagin (Figure 9.3). Other planning areas identified on this map are not currently scheduled for leasing.

The final 5-year OCS oil and gas leasing schedule was approved by the Secretary of the Interior on July 21, 1982. Adjustments in the sale schedule are regularly made, the most recent being October 24, 1984. Three lease sales have been held in the Bering Sea Subregion. Six other lease offerings are scheduled in this region through 1987 (see section 10.3.3). The Secretary of the Interior is required to maintain an oil and gas leasing program that "consists of a schedule of proposed lease sales indicating, as precisely as possible, the size, timing, and location of leasing activity" that will best meet national energy needs for a 5-year period following its approval or reapproval. In developing the schedule, the Secretary is required to take into account the potential impacts of oil and gas exploration on other offshore resources, including the marine, coastal, and human environments.

10.3.2 **Procedures.** Once a lease is awarded, before exploratory drilling can begin in any location, the lessee must submit an exploration plan to the Minerals Management Service for approval. An oilspill contingency plan must be contained within the exploration plan. If approved by MMS and having obtained other necessary permits, the lessee may conduct exploratory drilling and testing in keeping with lease sale stipulations and MMS Operating Orders.

If discoveries are made, before development and production can begin in a frontier lease area, a development plan must be submitted and a second EIS process begun. At this time, a somewhat better understanding of the location, magnitude, and nature of activity can be expected, and resource concerns may once again be addressed before development can be permitted to proceed.

If an oilfield is discovered, the decision to produce it depends on a number of factors, including the oilfield's size, depth, and formation conditions; drilling water depth; environmental constraints; distance to onshore facilities; regulatory constraints; and the projected price of oil. If a commercial quantity of petroleum is found in the Bering Sea, the effort would require construction of a production facility and all the necessary infrastructure for either pipelines to onshore storage and shipment terminals or to build offshore loading facilities.

10.3.3 **Schedule and location.**

Area	Date	Status
Norton Sound (#57)	3/15/83	Exploratory drilling underway
(#100)	12/85	2nd offering scheduled
St. George Basin (#70)	4/12/83	Exploratory drilling underway
(#89)	9/85	2nd offering scheduled
(#101)	4/87	3rd offering
Navarin Basin (#83)	3/84	Exploration to begin in 1985
(#107)	3/86	2nd offering
North Aleutian Basin (#92)	12/85	Reduced size of sale area
Shumagin (#86)	6/87	1st offering

10.3.4 **Potential effects on fisheries.**

10.3.4.1 **Oil and gas development.** See section 9.8.4.1 which describes pollution risks and interference by seismic vessel operations.

10.3.4.2 **Commercial Fishing - Oil Industry Conflicts.** Although the fishing industry is presently the major user of the Bering Sea, with the growth of petroleum industry activities in this area it is likely that conflicts will arise between the two industries. In addition to oil spills, there are several points of potential use conflicts that could affect the fishing industry, even without affecting the resource itself. These potential sources of conflict include preemption of fishing space, gear damage, contamination of catch, and competition for port facilities and supplies.

Loss of Fishing Grounds: Siting of offshore facilities, pipelines, safety zones and transportation corridors, and at least temporarily, a major oil spill could preempt fishing grounds. The extent of loss will depend on the number and locations of structures and the sizes of the safety zones required. These losses could persist throughout the life of the field (up to 25 years). In the North Sea, a loss of 0.79 sq. km is associated with each platform.

Damage to Fishing Gear: Seabed installations, unburied pipelines, mooring chains and anchors, or discarded debris could snag lines and trawls and cause damage or gear loss. Vessel traffic could entangle crab pots and line sets or their marker buoys. Avoidance of fishing gear sets will be hampered by frequent low visibility conditions of the area. An oil spill could contaminate gear.

Contamination of Catch: Oil-fouled gear could contaminate the catch and render it unmarketable. Oil-contaminated water could affect at-sea processors or live-holds of crabbers. Perceived tainting by the public as the result of publicity about a major oil spill could reduce product demand, price, or market for the fisherman.

Competition for Facilities and Supplies: Unalaska/Dutch Harbor is identified as the major oil industry support/supply base for the southern Bering Sea/Aleutian lease areas. It is also the major fishing port in Alaska. Limited availability of space and supplies will increase competition for them, and could inflate the prices for space, services, and goods between the fishing and petroleum industries.

18.0 **References.**

18.1 **General.**

18.2 **Sources Used in Preparing Habitat Amendment.**

Andriyashbev, A.P., **Fishes of the Northern Seas of the U.S.S.R.**, AKAD.NAUK SSR, Zool. Inst., OPREDELITEII Po Faune SSSR 53:1-570, in Russian, (translated by Israel Program Sci. Transl., Jerusalem, 1964, 617 pages, available from National Technical Information Service, Springfield, Virginia, OTS 63-111160). 1984

Bakkala, R.G. and G.B. Smith, **Demersal Fish Resources of the Eastern Bering Sea: Spring 1976**, Progress Report, NOAA/NMFS, Northwest and Alaska Fisheries Center, Seattle, Washington, 1978, 534 pp.

Berg, Ronald J., **An Updated Assessment of Biological Resources and their Commercial Importance in the St. George Basin of the Eastern Bering Sea** (OCSEAP Research Unit #437), National Marine Fisheries Service, Juneau, Alaska, March 1977, 116 pages.

Carlson, H. Richard, and Richard E. Haight, "Juvenile Life of Pacific Ocean Perch, Sebastes alutus, in Coastal Fiords of Southeastern Alaska: Their Environment, Growth, Food Habits, and Schooling Behavior," in **Transactions of the American Fisheries Society**, Vol. 105, No. 2, March 1976, 11 pages.

Carlson, H. Richard, and Richard R. Straty, "Habitat and Nursery Grounds of Pacific Rockfish, Sebastes, in Rocky Coastal Areas of Southeastern Alaska," in **Marine Fisheries Review**, Vol. 43, No. 7, July 1981, 7 pages.

Deis, Jeffrey, Robert Pierson, and Frederick Kurz, **Bering Sea Summary Report, Outer Continental Shelf Oil and Gas Activities in the Bering Sea and their Onshore Impacts**, U.S. Department of the Interior, Minerals Management Service, prepared for the Outer Continental Shelf Oil and Gas Information Program, Rogers, Golden & Halpern, Inc., Reston, Virginia, September 1983, 81 pages.

Garrison K.J. and B.S. Miller, **Review of Early Life History of Puget Sound Fish**, School of Fisheries, U.W., FRI-UW-8216, 1982, 729 pages.

Gusey, William F., **The Fish and Wildlife Resources of the Bering Sea Region**, Shell Oil Company, Houston, Texas, August 1979, nonsequentially numbered pages.

Hall, Alice S., and Fuad M. Teeny, and Erich J. Gauglitz, Jr., "Mercury in Fish and Shellfish of the Northeast Pacific. II. Sablefish, Anoplopoma Fimbria," in **Fishery Bulletin**, Volume 74, No. 4, 1976, 7 pages.

High, William L., "Escape of Dungeness Crabs from Pots," in **Marine Fisheries Review**, Volume 38, Number 4, April 1976, 6 pages.

High, William L., **Escape of King Crab, Paralithodes camtschatica, from Derelict Pots**, NMFS/NOAA Technical Report, NMFS SSRF-734, 1979, 11 pages.

Hood, Donald W., and John A. Calder (editors), **The Eastern Bering Sea Shelf: Oceanography and Resources, Volumes I and II**, Office of Marine Pollution Assessment, National Oceanic and Atmospheric Administration, 1981, 1339 pages.

Lackey, Robert T., and Larry A. Nielsen (Editors), **Fisheries Management**, Halsted Press, New York, 1980, 422 pages.

Lewbel, George S. (Editor), **Bering Sea Biology: An Evaluation of the Environmental Data Base Related to Bering Sea Oil and Gas Exploration and Development**, LGL Alaska Research Associates, Inc., Anchorage, Alaska, and SOHIO Alaska Petroleum Company, Anchorage, Alaska, 1983, IV + 180 pages.

Lynde, C. Macgill, "Juvenile and Adult Walleye Pollock of the Eastern Bering Sea: Literature Review and Results of Ecosystem Workshop," in **Proceedings of the Workshop on Walleye Pollock and its Ecosystem in the Eastern Bering Sea**, NOAA Technical Memorandum NMFS F/NWC-62, Seattle, Washington, August 1984, 65 pages.

Major, R.L., and H.H. Shippen, **Synopsis of Biological Data on Pacific Ocean Perch, Sebastus alutus**, NOAA/NMFS, Circular 347, 1970, 38 pages.

McCain, Bruce B., W.D. Gronlund, and M.S. Myers, Tumors and microbial diseases of marine fishes in Alaskan Waters, **Journal of Fish Diseases** 1979, 2, 111-130.

Merrell, Theodore R., Jr., "A Decade of Change in Nets and Plastic Litter from Fisheries Off Alaska," in **Marine Pollution Bulletin**, Volume 15, No. 10, October 1984, pages 378 to 384.

Morris, Byron F., **An Assessment of the Living Marine Resources of the Central Bering Sea and Potential Resource Use Conflicts between Commercial Fisheries and Petroleum Development in the Navarin Basin, Proposed Sale 83**, National Marine Fisheries Service, Anchorage, Alaska, 1981, 232 pages.

National Marine Fisheries Service, **Living Marine Resources, Commercial Fisheries and Potential Impacts of Oil and Gas Development in the St. George Basin, Eastern Bering Sea**, Northwest and Alaska Fisheries Center, Juneau, Alaska, 1979, 133 pages.

National Marine Fisheries Service, **Living Marine Resources and Commercial Fisheries Relative to Potential Oil and Gas Development in the Northern Aleutian Shelf Area**, Northwest and Alaska Fisheries Center, Juneau, Alaska, 1980, 92 pages.

Outer Continental Shelf Environmental Assessment Program, Juneau, Alaska, Hameedi, M. J. (Editor), **Proceedings of a Synthesis Meeting: The St. George Basin Environment and Possible Consequences of Planned Offshore Oil and Gas Development Anchorage, Alaska - April 28-30, 1981**, U.S. Department of Commerce National Oceanic & Atmospheric Administration Office of Marine Pollution Assessment, U.S. Department of the Interior, Bureau of Land Management, March 1982, 162 pages.

Outer Continental Shelf Environmental Assessment Program, Juneau, Alaska, Jarvela, Laurie E. (Edited by), **The Navarin Basin Environment and Possible Consequences of Planned Offshore Oil and Gas Development**, a Synthesis Report, U.S. Department of Commerce National Oceanic & Atmospheric Administration Office of Marine Pollution Assessment, U.S. Department of the Interior, Bureau of Land Management, May, 1984, 157 pages.

Outer Continental Shelf Environmental Assessment Program, Juneau, Alaska, Thorsteinson, Lyman K. (Edited by), **Proceedings of a Synthesis Meeting: The North Aleutian Shelf Environment and Possible Consequences of Offshore Oil and Gas Development, Anchorage, Alaska, 9-11 March 1982**, U.S. Department of Commerce National Oceanic & Atmospheric Administration Office of Marine Pollution Assessment, U.S. Department of the Interior, Bureau of Land Management, March 1984, 159 pages.

Pereyra, W.T., J.E. Reeves and R.G. Bakkala, **Demersal Fish and Shellfish Resources of the Eastern Bering Sea in the Baseline Year 1975**, Progress Report OCSEAP RU No. 175, NOAA and BLM, Northwest and Alaska Fisheries Center, October 1976, 619 pages.

Rice, Stanley D., D. Adam Moles, John F. Karinen, Sid Korn, Mark G. Carls, Christine C. Brodersen, Jessica A. Gharrett, and Malin M. Babcock, **Effects of Petroleum Hydrocarbons on Alaskan Aquatic Organisms: A Comprehensive Review of All Oil-Effects Research on Alaskan Fish and Invertebrates Conducted by the Auke Bay Laboratory, 1970-1981**, NOAA Technical Memorandum, NMFS F/NWC-67, November 1984, 128 pages.

Rounsefell, G.A., **Ecology, Utilization, and Management of Marine Fisheries**, St. Louis: C.V. Mosby, 1975, pages.

Royce, William F., **Introduction to the Fishery Sciences**, Academic Press, New York, 1972, 351 pages.

Schumacher, James D., "Oceanography," in **Proceedings of the Workshop on Walleye Pollock and its Ecosystem in the Eastern Bering Sea**, NOAA Technical Memorandum NMFS F/NWC-62, Seattle, Washington, August 1984, 29 pages.

Thorsteinson, F.V., and L.K. Thorsteinson, "Finfish Resources," in **Proceedings of a Synthesis Meeting: The St. George Basin Environment and Possible Consequences of Planned Offshore Oil and Gas Development**, Outer Continental Shelf Environmental Assessment Program, U.S. Departments of Commerce and Interior, March 1982, 28 pages.

U.S. Department of the Interior, Minerals Management Service, **St. George Basin Final Environmental Impact Statement, Proposed Outer Continental Shelf Oil and Gas Lease Sale 70**, August 1982, unnumbered pages with Final Supplemental Environmental Impact Statement.

University of Aberdeen, **A Physical and Economic Evaluation of Loss of Access to Fishing Grounds due to Oil and Gas Installations in the North Sea**, March 1978, 152 pages.

Wolotira, Robert J., **Demersal Fish and Shellfish Resources of Norton Sound, The Southeastern Chukchi Sea, and Adjacent Waters in the Baseline Year 1976**, U.S. Department of Commerce, NOAA, NMFS, Northwest and Alaska Fisheries Center, Processed Report, October 1977, 292 pages.

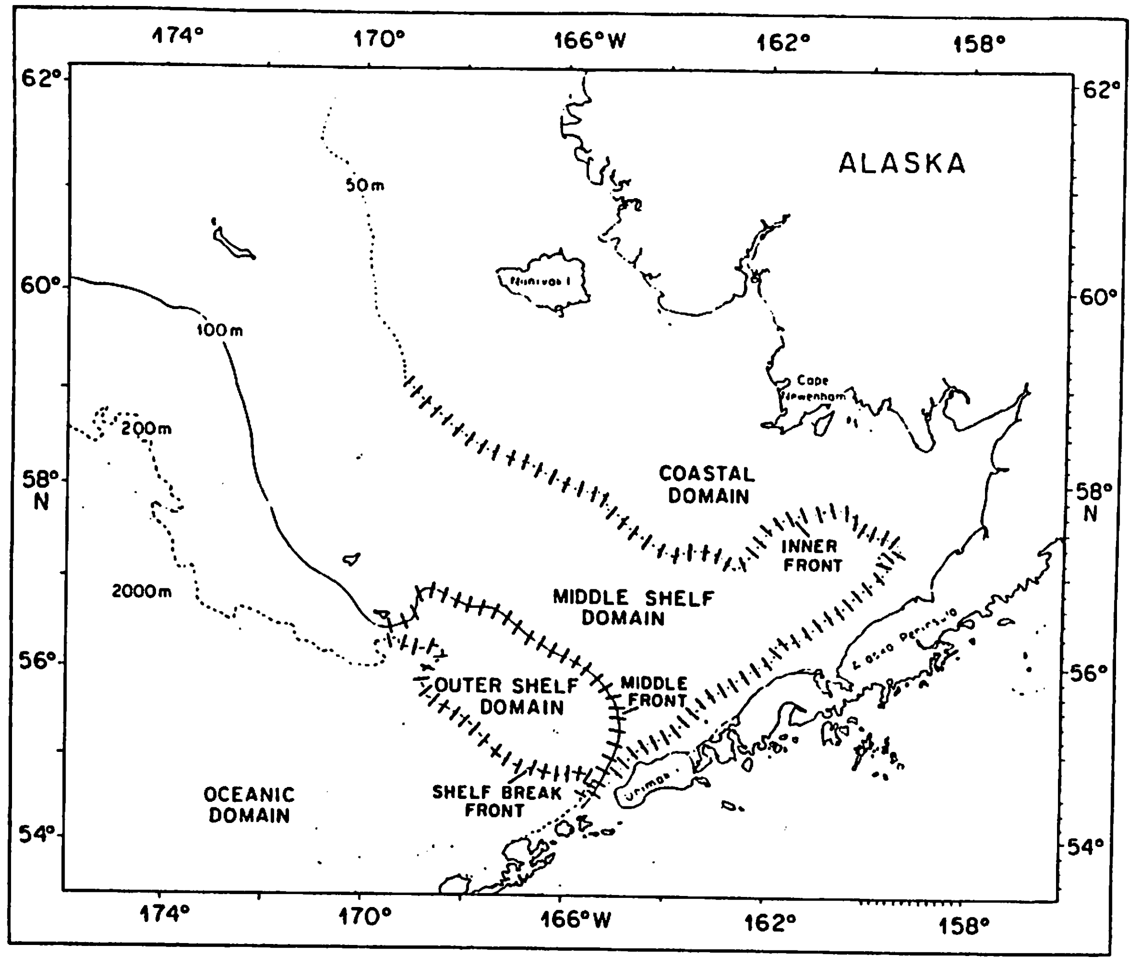
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Figure 9.1

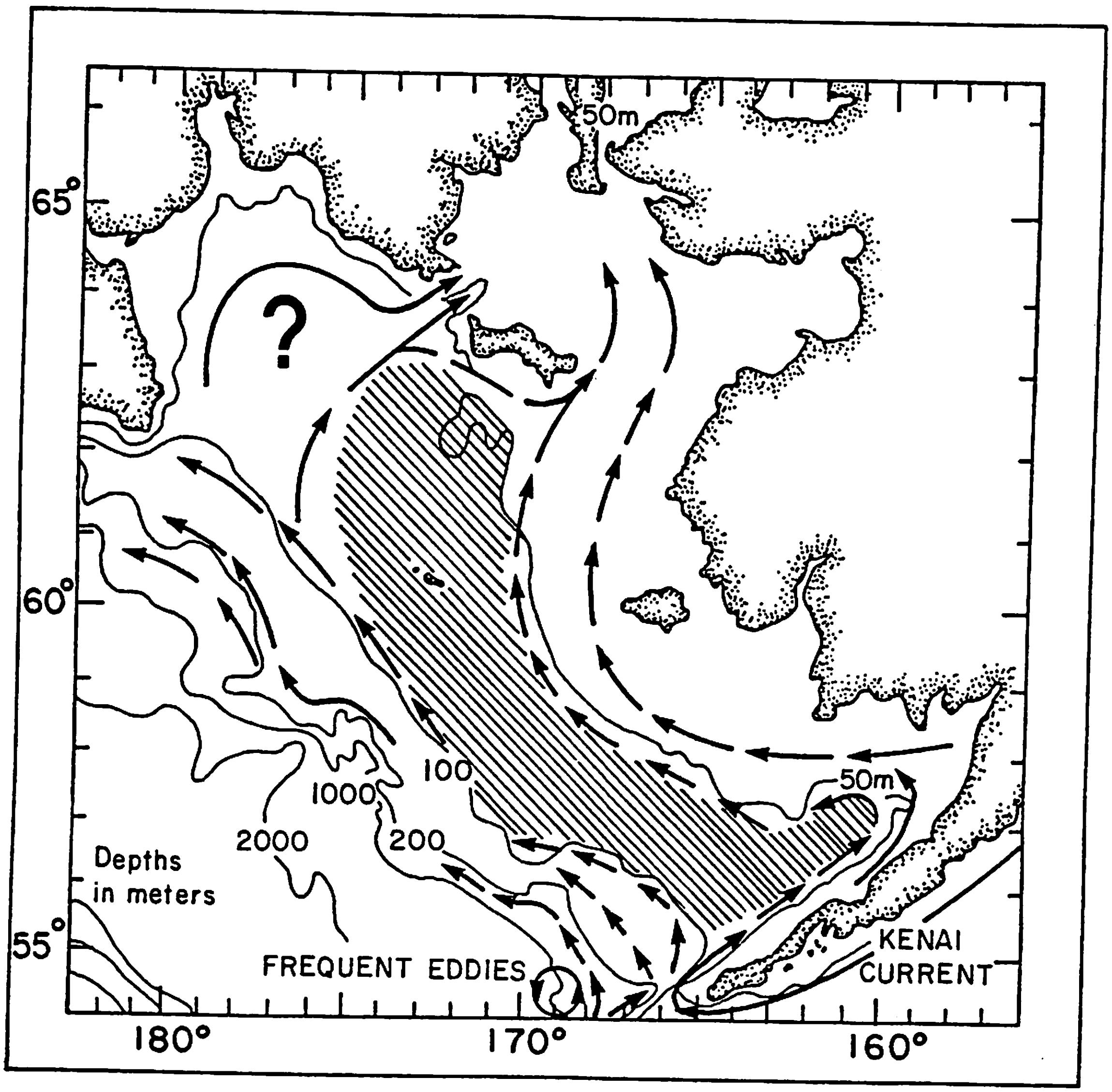
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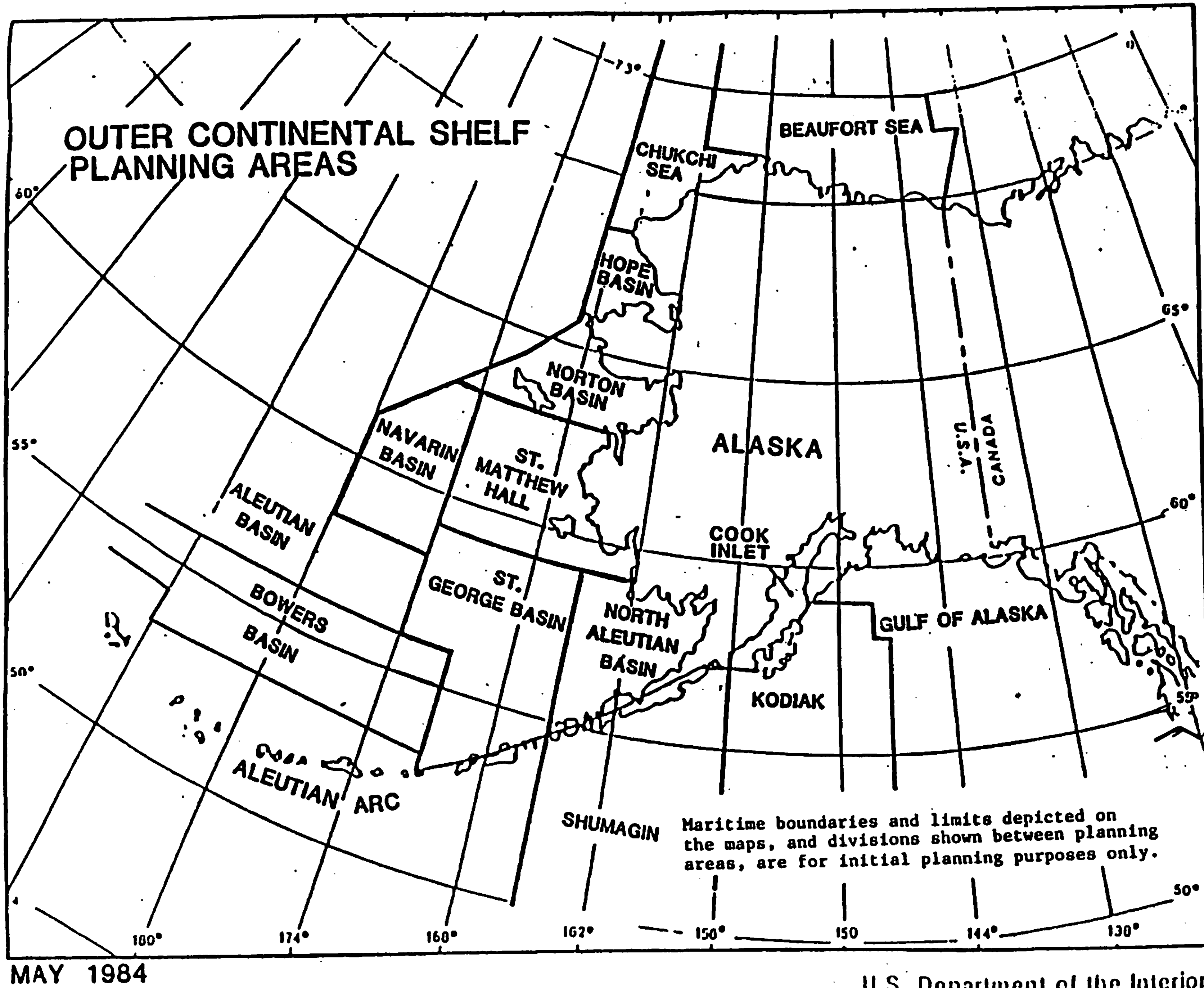
Figure 9.2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NORTON BASIN
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U.S.A.
CANADA
COOK INLET
ALEUTIAN BASIN
ST. GEORGE BASIN
NORTH ALEUTIAN BASIN
GULF OF ALASKA
BOWERS BASIN
KODIAK
ALEUTIAN ARC
SHUMAGIN
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Figure 9.3