FISHERY MANAGEMENT PLAN

FOR THE

BERING SEA/ALEUTIAN ISLANDS GROUNDFISH

MARCH 1991

<u>Incorporates Amendment 1 through 16</u>

North Pacific Fishery Management Council
P.O. Box 103136
Anchorage, AK 99510

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2.0 SUMMARY SHEET

FISHERY MANAGEMENT PLAN FOR THE GROUNDFISH FISHERY IN THE BERING SEA/ALEUTIAN ISLANDS AREA

(X) Final ( ) Draft Environmental Impact Statement

Responsible Agencies:

North Pacific Fishery Management Council
Contact: Clarence G. Pautzke, Executive Director
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National Marine Fisheries Service
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P.O. Box 1668
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1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: The proposed action is to adopt and implement a fishery management plan for the groundfish fishery in the Bering Sea/Aleutian Islands area under the provisions of Title III of the Magnuson Fishery Conservation and Management Act of 1976 (P.L. 94-265). This act extends jurisdiction over fishery resources and establishes a program for their management. The purpose of the plan is to manage the groundfish fishery in the Bering Sea/Aleutian Islands area for the optimum yield and to allocate harvest between domestic and foreign fishermen.

3. Summary:
Environmental Impacts. Implementation of this fishery management plan within the limit of its constraints is presumed not to cause adverse impacts on the environment. Conservation measures are provided for species for which they are deemed necessary. Those measures and the conduct of the fishery as outlined will be beneficial to the ocean environment affected, to demersal and pelagic fishes and to the human environment.

4. Alternatives: The following alternatives are considered:
   (a) No action.
   (b) Regulation of foreign fishery only.
   (c) Continuation of present management regime.

5. Comments Requested: Comments have been requested, received, and considered in conformance with P.L. 94-265 and other applicable law.

6. Hearings: Hearings were held in conformance with P.L. 94-265 and other applicable law.

7. Draft Statement to CEQ: September 6, 1978

8. Final Statement to CEQ: November 20, 1981

2.1 History and Summary of Amendments

Amendment 1, approved by the Secretary of Commerce July 26, 1983. Implemented January 1, 1984, supersedes Amendments 2 and 4:

(1) Established a multi-year, multi-species optimum yield for the groundfish complex (Section 11).

(2) Established a framework procedure for determining and apportioning TAC, Reserves, and DAH (Sections 11 and 12).

(3) Eliminated the "Misty Moon" grounds south of the Pribilof Islands from the Winter Halibut Savings Area (Section 14).

(4) Allowed experimental year-round domestic trawling in the Winter Halibut Savings Area that will be closely monitored to the extent possible (Section 14).

(5) Allowed year-round domestic trawling in the Bristol Bay Pot Sanctuary and year-round domestic longlining in the Winter Halibut Savings Area (Section 14).

(6) Closed the Petrel Bank area to foreign trawling from July 1 through June 30.

(7) Established the Resource Assessment Document as the biological information source for management purposes (Section 11 and Annex I).

(8) Specified that the fishing and FMP year is the calendar year.

Amendment 1a, implemented January 2, 1982:

Set a chinook salmon prohibited species catch limit of 55,250 fish for the foreign trawl fisheries for 1982.

Amendment 2, implemented January 12, 1982:

(1) For Yellowfin Sole, increased DAH to 26,000 mt from 2,050 mt, increased JVP 25,000 mt from 850 mt, and decreased TALFF by 24,150 mt.

(2) For Other Flatfish, increased DAH to 4,200 mt from 1,300 mt, increased JVP to 3,000 mt from 100 mt, and decreased TALFF by 2,900 mt.

(3) For Pacific Cod, decreased MSY to 55,000 mt from 58,700 mt, increased EY to 160,000 mt from 58,700 mt, increased ABC to 160,000 mt from 58,700 mt, increased OY to 78,700 mt from 58,700 mt, increased Reserves to 3,935 mt from 2,935 mt, increased DAP to 26,000 mt from 7,000 mt, and increased DAH to 43,265 mt from 24,265 mt.

Amendment 3, implemented July 4, 1983, supersedes Amendments 1a and 5:

(1) Established procedures for reducing the incidental catch of halibut, salmon, king crab and Tanner crab by the foreign trawl fisheries (Section 14).

(2) Established a Council policy on the domestic groundfish fisheries and their incidental catch of prohibited species (Section 14).

Amendment 4, implemented May 9, 1983, supersedes Amendment 2:

(1) For Pollock, increased JVP for Bering Sea to 64,000 mt from 9,050 mt, increased DAH to 74,500 mt from 19,550 mt, and decreased TALFF to 875,500 mt from 930,450 mt.

(2) For Yellowfin Sole, increased JVP to 30,000 mt from 25,000 mt, increased DAH to 31,200 mt from 26,200 mt, and decreased TALFF to 79,950 mt from 84,950 mt.

(3) For Other Flatfish, increased JVP to 10,000 mt from 3,000 mt, increased DAH to 11,200 mt from 4,200 mt, and decreased TALFF to 46,750 mt from 53,750 mt.

(4) For Atka Mackerel, increased JVP to 14,500 mt from 100 mt, increased DAH to 14,500 mt from 100 mt, and decreased TALFF to 9,060 mt from 23,460 mt.

(5) For Other Species, increased JVP to 6,000 mt from 200 mt, increased DAH to 7,800 mt from 2,000 mt, and decreased TALFF to 65,648 mt from 68,537 mt. Also corrected ABC to 79,714 mt, OY to 77,314 mt, and reserves to 3,866 mt.

(6) For Pacific Cod, increased EY and ABC to 168,000 mt from 160,000 mt, increased OY to 120,000 mt from 78,700 mt, increased Reserves to 6,000 mt from 3,935 mt, and increased TALFF to 70,735 mt from 31,500 mt.

(7) For Other Rockfish, assigned DAP of 1,100 mt to BSAI area combined. This caused no change in total DAP. (This conformed FMP with federal regulations.)

(8) For Pacific Ocean Perch, assigned DAP of 550 mt to Bering Sea and 550 mt to Aleutians but caused no change in total DAP. Also assigned JVP of 830 mt to Bering Sea and 830 mt to Aleutians without changing total JVP. (This conformed FMP with federal regulations.)

(9) For Sablefish, assigned JVP of 200 mt to Bering Sea and 200 mt to Aleutians without changing total JVP. (This conformed FMP with federal regulations.) Changed MSY to 11,600 mt in Bering Sea and 1,900 mt in Aleutians to eliminate inconsistencies with annexes.

(10) Changed foreign fisheries restrictions to allow trawling outside 3 miles north of the Aleutians between 170°30'W and 172°W and south of the Aleutians between 170°W and 172°W; and to allow longlining outside 3 miles west of 170°W.

(11) Established the authority of the Secretary of Commerce to issue field orders for conservation reasons. (Disapproved by Secretary of Commerce.)

Amendment 5, withdrawn from Secretarial review:

Decreased chinook salmon PSC from 55,250 fish to 45,500 fish for 1983. This amendment was withdrawn from Secretarial review because Amendment 3 was implemented in time to protect chinook salmon in 1983.

Amendment 6, disapproved by NMFS on December 8, 1983:

Establishes a fishery development zone for exclusive use by U.S. fishing vessels where no foreign directed fishing is permitted.

Amendment 7, implemented August 31, 1983:

Modified the December 1 to May 31 depth restriction on the foreign longline fisheries in the Winter Halibut Savings Area (Section 14).

Amendment 8, implemented February 24, 1984, supplements Amendment 3:

Established 1984 and 1985 salmon PSCs for the foreign trawl fishery. This amendment was a regulatory amendment which fell within the purvue of Amendment 3 and did not require formal Secretarial approval.

Amendment 9, implemented December 1, 1985:

(1) Closed areas west of 170°W within 20 miles to foreign trawling year-round. (Disapproved by NMFS.)
(2) Require all catcher/processors that hold their catch for more than two weeks to check in and check out by radio from a regulatory area/district and to provide a written catch report weekly to the NMFS Regional Office.
(3) Incorporated habitat protection policy. (A proposed regulation authorized by this part of Amendment 9 is reserved until an analysis of the measure is prepared.)
(4) Established definition for directed fishing as 20% or more of the catch.

Amendment 10, implemented March 16, 1987:

(1) Established Bycatch Limitation Zones for domestic and foreign fisheries for yellowfin sole and other flatfish (including rock sole); an area closed to all trawling within Zone 1; red king crab, C. bairdi Tanner crab, and Pacific halibut Prohibited Species Catch (PSC) limits for DAH yellowfin sole/other flatfish fisheries; a C. bairdi PSC limit for foreign fisheries; and a red king crab PSC limit and scientific data collection requirement for U.S. vessels fishing for Pacific cod in Zone 1 waters shallower than 25 fathoms.
(2) Revised the weekly reporting requirement for catcher/processors and mothership/processors.
(3) Established explicit authority for reapportionment between DAP and JVP fisheries.
(4) Established inseason management authority.

Amendment 11, implemented December 30, 1987:

(1) Established a schedule for seasonal release of joint venture pollock apportionments in 1988 and 1989 (expires December 31, 1989).
(2) Revised the definition of prohibited species.
(3) Revised the definition of acceptable biological catch (ABC) and added definitions for threshold and overfishing.

Amendment 11a, implemented April 6, 1988:

Augmented the current domestic catcher/processor and mothership/ processor reporting requirements with at-sea transfer information and modify the weekly reporting requirements.

Amendment 12, implemented May 26, 1989:

(1) Revised federal permit requirements to include all vessels harvesting and processing groundfish from the EEZ.
(2) Establish a prohibited species catch (PSC) limit procedure for fully utilized groundfish species taken incidentally in JVP and TALFF fisheries.
(3) Removed July 1 deadline for Stock Assessment and Fishery Evaluation Report (SAFE).
(4) Established rock sole as a target species distinct from the "other flatfish" group.

Amendment 12a, implemented September 3, 1989:

Established a bycatch control procedure to limit the incidental take of C. bairdi Tanner crab, red king crab, and halibut in groundfish fisheries.

Amendment 13, implemented January 1, 1990:

(1) Allocated sablefish in the Bering Sea and the Aleutian Islands Management Subareas.
(2) Established a procedure to set fishing seasons on an annual basis by regulatory amendment.
(3) Established groundfish fishing closed zones near the Walrus Islands and Cape Peirce.
(4) Established a new data reporting system.
(5) Established a new observer program.
(6) Clarified the Secretary's authority to split or combine species groups within the target species management category by a framework procedure.

Amendment 14, implemented January 1, 1991:

(1) prohibited roe-stripping of pollock; and established Council policy that the pollock harvest is to be used for human consumption to the maximum extent possible;

(2) divided the pollock TAC into two seasonal allowances: roe-bearing and non roe-bearing. The percentage of the TAC allocated to each allowance shall be determined annually during the TAC specifications process.

Amendment 16, implemented January 1, 1991:

(1) Extended the effective data of Amendment 12a (originally scheduled to expire December 31, 1990) with the following three changes:

- Prohibit species catch (PSC) apportionments would be established for the DAP rock sole and deep water turbot/arrowtooth founder fisheries;
- PSC limits could be seasonally apportioned; and
- An interim incentive program established to encourage vessels to avoid excessive bycatch rates.

(2) Established a definition of overfishing;

(3) Established procedures for interim TAC specifications; and

(4) Provided for fishing gear restrictions to be modified by regulatory amendments.

3.0 EXECUTIVE SUMMARY

MANAGEMENT OBJECTIVES TO BE ATTAINED

1. Promote conservation while providing for optimum yield from the region'sgroundfish resources in terms of:

   (a) Providing the greatest overall benefit to the nation with particular reference to food production and recreational opportunities;
   (b) Avoiding long-term or irreversible adverse effects on fishery resources and the marine environment;
   (c) Insuring availability of a multiplicity of options with respect to future uses of these resources.

2. Promote, where possible, efficient use of the fishery resources but not solely for economic purposes.

3. Promote fair and equitable allocation of identified available resources in a manner that no particular group acquires an excessive share of the privileges.

4. Base the plan on the best scientific information available.

ECOLOGICAL, ECONOMIC AND SOCIAL IMPACTS

Ecological Impacts

In the context of long-term relationships, fishery managers are just now beginning to find out, understand and quantify the complex relations among species and between the biota and the environment of the ecosystem in the Bering Sea/Aleutian Islands area. Until that understanding is more fully developed, it is not possible to predict the long-term effect on the ecosystem of the current, single species management strategies (as opposed to the integrated ecosystem method) or of subtle environmental changes.

The quantitative processes in the marine ecosystem are beginning to be simulated and studied with numerical, dynamic, deterministic marine ecosystem reproduction models.

It is generally recognized by fisheries scientists that the existing theories and models pertaining to fishery resources management suffer some fundamental inadequacies; concepts and theories must be developed to answer present and future management decisions. Until such new concepts supercede the old, the latter can still serve as a useful basis for deriving management decisions, providing their limited and underlying assumptions are recognized and evaluated with the best available information. This is the philosophy and approach used throughout this plan.

Economic Impacts

The number of vessels operating in this fishery management area has been so small that specific information cannot be disclosed without violating the confidentiality of individual reports. There is a slightly larger groundfish fishery for bait used by crabbers operating in the fishery.

OPTIMUM YIELD (OY), DOMESTIC ANNUAL HARVEST (DAH), AND TOTAL ALLOWANCE LEVEL OF FOREIGN FISHING (TALFF) IN 1983
(Metric Tons)

Reference: Species group	Sub-area1/	1983 OY	Reserve	DAH	TALFF
Pollock	Bering Sea	1,000,000	50,000	74,500	875,500
Pollock	Aleutian	100,000	2/	--	100,000
Yellowfin Sole		117,000	5,850	31,200	79,950
Turbots		90,000	4,500	1,075	84,425
Other flatfishes		61,000	3,050	11,200	46,750
Pacific Cod		120,000	6,000	43,265	70,735
Pacific ocean perch	Bering Sea	3,250	162	1,380	1,708
Pacific ocean perch	Aleutian	7,500	375	1,380	5,745
Other Rockfish		7,727	500	1,550	5,677
Sablefish	Bering Sea	3,500	350	700	2,450
Sablefish	Aleutian	1,500	150	700	650
Atka mackerel		24,800	1,240	14,500	9,060
Squid		10,000	500	50	9,450
Other		77,314	3,866	7,800	65,648
Total		1,623,591	76,543	189,300	1,357,748

*1/ BS Bering Sea (fishing Areas I, II, III combined).
AL Aleutian Island Area (Fishing Area IV).

2/ This OY calculated for the offshore pollock population in deep water discussed in Annex I (p. AI-70). No reserve is considered necessary at this time since there is little U.S. capability for a pelagic trawl fishery and resource abundance on the continental shelf is expected to keep any U.S. effort on that component identified as "B. Sea."

MSY, EY, AND ABC VALUES FOR GROUNDFISH IN THE BERING SEA/ALEUTIAN REGION (1000's MT) IN 1982

Species	Sub-area[1]	MSY	EY	ABC	OY
Pollock	BS	1,100-1,600	1,000	1,000	1,000
	AL	--	--	100	100
Yellowfin Sole	--	169-260	117	117	117
Turbots	--	100	90-95	90	90
Other flatfishes	--	44.3-76.8	=MSY	61	61
Cod	--	55.0	168	168	120
Pacific ocean perch	BS	32	6.5	3.25	3.25
	AL	75	15	7.5	7.5
Other Rockfish	--	--	--	7.727	7.727
Sablefish	BS	11.6	3.5	3.5	3.5
	AL	1.9	1.5	1.5	1.5
Atka mackerel	--	33	Unknown	24.8	24.8
Squid	--	10	10	10	10
Other included species	--	89.4	89.4	79.714	77.314
Total	--	1,721.2 - 2,344.7	1,545.2-1,582.7	1,673.991	1,623.591

1/ BS = Eastern Bering Sea Area (Fishing Areas I, II, III combined).
AL = Aleutian Area (Fishing Area IV).

In all, the total domestic commercial groundfish catch in the Bering Sea/Aleutians region (excluding halibut) is thought to be no more than 1,500 mt in any recent year.

Although substantial freezing and transshipping facilities are located at Dutch Harbor (Unalaska), with the exception of very small amounts of groundfish frozen for crab bait, no groundfish processing (except halibut) has occured in this region in recent years.

The viability of a domestic Bering Sea groundfish fishery will ultimately depend on the ability of U.S. industry to market products at prices which cover their production costs.

The impact of this FMP on the domestic socioeconomic climate will be in direct proportion to the participation of Americans in the fishery. It is presumed that any financially sound participation in the future will result in increased employment opportunities and the benefits associated with development above the present low level.

Social Impacts

The relatively undeveloped nature of this fishery makes obvious the fact that any development will immediately impact the social climate. Employment is in direct proportion to plant development and processing capabilities. Certainly, initial efforts will be at least tentative and exploratory in nature. The single vessel now (spring, 1979) participating in a joint venture is being used by prospective fishermen as a bellwether. The reader is referred to a fact sheet contained in the comment section of this plan for a pr'ecis of conditions in the fishery.

4.0 INTRODUCTION TO THE PLAN

This Fishery Management Plan (FMP) has been developed by the North Pacific Fishery Management Council and is for the groundfish fishery, excluding halibut and herring, of the Bering Sea/Aleutian Islands area. It is intended to replace all of the current Preliminary Fishery Management Plan (PFMP) for the Trawl and Herring Gillnet Fisheries of the Bering Sea and Aleutians except that portion dealing with herring. Both of those PFMPs were developed by the National Marine Fisheries Service and implemented by the Secretary of Commerce in early 1977.

One feature of the format of this FMP is that such items as Allowable Biological Catch, Expected Domestic Annual Harvest, Total Allowable Level of Foreign Fishing, and annual catch statistics which are likely to change from time to time have been arranged in Annexes. This should facilitate both the drafting and review process when such changes are made in the future.

4.1 Description of the Management Unit

The geographical extent of this Management Unit is the entire Exclusive Economic Zone (EEZ) of the Bering Sea, including Bristol Bay and Norton Sound, and that portion of the EEZ of the North Pacific Ocean which is adjacent to the Aleutian Islands west of 170°W.

In terms of both the fishery and the groundfish resource, the Bering Sea/ Aleutians groundfish fishery (excluding halibut) forms a distinct management unit. The history of fishery development, target species and species composition of the commercial catch, bathemetry, and oceanography are all much different in that Region than in the adjacent Gulf of Alaska. Although many species occur over a broader range than the Bering Sea/Aleutians Region, with only a few exceptions (e.g. halibut and perhaps sablefish) stocks of common species in this Region are believed different from those in the adjacent Gulf of Alaska.

Even though the International Pacific Halibut Commission is responsible for management of the North American Pacific halibut fishery, the potential adverse impact on halibut of a fishery for other groundfish species is so great that it must be taken into account in the management of the groundfish fishery. Therefore, certain pertinent aspects of the halibut resource and the directed fishery it supports are described in this Fishery Management Plan. Throughout this document, the terms "groundfish" and "bottomfish" exclude Pacific halibut unless otherwise noted.

This Fishery Management Plan follows almost exactly the "Outline for Fishery Management Plans" adopted by the North Pacific Council and forms the major component of an Environmental Impact Statement which assesses the effect that implementation of this Plan is expected to have on the environment of the region which encompasses the eastern Bering Sea and Aleutian Islands archipelago.

4.2 Goals for Management Plan

The North Pacific Fishery Management Council has determined that all its fishery management plans should, in order to meet the requirements of its constituency, the resources and FCMA, achieve the following goals:

1. Promote conservation while providing for the optimum yield from the Region's groundfish resource in terms of: providing the greatest overall benefit to the nation with particular reference to food production and recreational opportunities; avoiding irreversible or long-term adverse effects on fishery resources and the marine environment; and insuring

availability of a multiplicity of options with respect to the future uses of these resources.

2. Promote, where possible, efficient use of the fishery resources but not solely for economic purposes.

3. Promote fair and equitable allocation of identified available resources in a manner such that no particular group acquires an excessive share of the privileges.

4. Base the plan on the best scientific information available.

In accomplishing these broad objectives a number of secondary objectives have been considered:

1. Conservation and management measures have taken into account the unpredictable characteristics of future resource availability and socioeconomic factors influencing the viability of the industry.

2. Where possible, individual stocks of fish are managed as a unit throughout their range, but such management is in due consideration of other impacted resources.

3. In such instances when stocks have declined to a level below that capable of producing MSY, management measures promote rebuilding the stocks. In considering the rate of rebuilding, factors other than biological considerations have been taken into account.

4. Management measures, while promoting efficiency where practicable, are designed to avoid disruption of existing social and economic structures where fisheries appear to be operating in reasonable conformance with the Act and have evolved over a period of years as reflected in community characteristics, processing capability, fleet size and distribution. These systems and the resources upon which they are based are not static, but change in the existing regulatory regime should be the result of considered action based on data and public input.

5. Management measures should contain a margin of safety in recommending allowable biological catches when the quality of information concerning the resource and ecosystem is questionable. Management plans should provide for accessing biological and socioeconomic data in such instances where the information base is inadequate to effectively establish the biological parameters of the resource or to reasonably establish optimum yield. This plan has identified information and research required for further plan development.

6. Fishing strategy has been designed in such a manner as to have minimal impact on other fisheries and the environment.

4.3 Operational Definitions of Terms

1. Determinants of catch levels.

    a. Maximum sustainable yield (MSY) is an average over a reasonable length of time of the largest catch which can be taken continuously from a stock under current environmental conditions. It should normally be presented with a range of values around its point estimate.

    Where sufficient scientific data as to the biological characteristics of the stock do not exist or the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, the MSY will be estimated from the best information available.

b. Equilibrium yield (EY) is the annual or seasonal harvest which allows the stock to be maintained at approximately the same level of abundance (apart from the effects of environmental variation) in successive seasons or years.

c. Acceptable biological catch (ABC) is a seasonally determined catch or range of catches that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitments. Given suitable biological justification by the Plan Team and/or Scientific and Statistical Committee, the ABC may be set anywhere between zero and the current biomass less the threshold value. The ABC may be modified to incorporate safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the maximum sustainable yield exploitation rate multiplied by the size of the biomass for the relevant time period. The ABC is defined as zero when the stock is at or below its threshold.

d. Threshold is the minimum size of a stock that allows sufficient recruitment so that the stock can eventually reach a level that produces MSY. Implicit in this definition are rebuilding schedules. They have not been specified since the selection of a schedule is a part of the OY determination process. Interest instead is on the identification of a stock level below which the ability to rebuild is uncertain. The estimate given should reflect use of the best scientific information available. Whenever possible, upper and lower bounds should be given for the estimate.

e. Overfishing is defined as a maximum allowable fishing mortality rate. For any stock or stock complex under management, the maximum allowable mortality rate will be set at the level corresponding to maximum sustainable yield (F_{msy}) for all biomass levels in excess of the level corresponding to maximum sustainable yield (B_{msy}). For lower biomass levels, the maximum allowable fishing mortality rate will vary linearly with biomass, starting from a value of zero at the origin and increasing to a value of Fmsy at Bmsy, consistent with other applicable laws.

If data are insufficient to calculate F_{msy} or B_{msy}, the maximum allowable fishing mortality rate will be set equal to the following (in order of preference):

(1) the value that results in the biomass-per-recruit ratio (measured in terms of spawning biomass) falling to 30% of its pristine value;

(2) the value that results in the biomass-per-recruit ratio (measured in terms of exploitable biomass) falling to 30% of its pristine value; or

(3) the natural mortality rate (M).

If data are insufficient to estimate any of the above, the TAC shall not exceed the average catch taken since 1977.

f. Optimum yield (OY) may be obtained by a plus or minus deviation from ABC for purposes of promoting economic, social or ecological objectives as established by law and public participation processes. Ecological objectives, where they primarily relate to biological purposes and factors, are included in the determination of ABC. Where biological objectives relate to resolving conflicts and accommodating competing uses and values, they are included as appropriate with economic and/or social objectives. OY may be set higher than ABC in order to produce higher yields from other more desirable species in a multispecies fishery. It might be set lower than ABC in order to provide larger sized individuals or a higher average catch per unit effort, or to rebuild overfished stocks.

The OY of the groundfish complex is 1.4 to 2.0 million mt to the extent that this can be harvested consistently with the management measures specified in this FMP.

2. Determination of domestic annual fishing capacity, expected harvest, and fishing capacity.

   a. Domestic annual fishing capacity (DAC) is the total potential physical capacity of the fleets, modified by logistic factors. The components of the concept are:

      (1) An inventory of total potential physical capacity, defined in terms of appropriate vessel and gear characteristics (e.g. size, horsepower, hold capacity, gear design, etc.).

      (2) Logistic factors determining total annual fishing capacity (e.g., variations in vessel and gear performance, trip length between fishing locations and landing points, weather constraints, etc.).

   b. Domestic annual harvest (DAH) is the estimated total harvest of groundfish by U.S. fishermen. It is delivered to U.S. or foreign processors or nonprocessed markets such as for bait for crab pots.

   c. Domestic annual processing (DAP) is the estimated portion of the U.S. groundfish catch delivered to U.S. shorebased or floating processors or U.S. nonprocessed bait markets.

   d. Joint venture processing (JVP) is the estimated portion of the U.S. groundfish catch that exceeds the capacity and intent of U.S. processors to utilize, or for which domestic markets are unavailable, that is expected to be delivered to foreign processors in the Fishery Conservation Zone.

   These concepts should be placed in a dynamic context of past trends and future projections. For example, physical fleet capacity should not simply be last season's inventory of vessels and hold measurements (although this is appropriate for present interim planning), but also next year's projected movement into and out of the fishery. Vessels under construction should be included and attrition should be estimated.

   The determination of domestic annual fishing capacity, expected harvest and processing capacity and intent should be made on the best available information.

3. The foreign allowable catch is determined by deducting the expected domestic annual harvest and the reserves from the total allowable catch, as described in Section 11.4.

5.0 DESCRIPTION OF FISHERY

5.1 Areas and Stocks Involved

5.1.1 Description of Areas

The Bering Sea/Aleutian Islands region with respect to U.S. extended jurisdiction is defined as those waters lying south of the Bering Strait, east of the U.S.-U.S.S.R. convention line of 1867, and extending south of the Aleutian Islands for 200 miles between the convention line and 170°W (Figures 1 and 2). Waters lying south of lines joining headlands in the eastern Aleutian Islands, east of 170°W, are considered a part of the Gulf of Alaska management area. The most prominent and unique feature of the Bering Sea is the extensive continental shelf in the eastern and northern portion of the sea. It constitutes approximately 80% of the total shelf area in the Bering Sea (Hood and Kelly 1974) and is one of the world's largest. For the Bering Sea as a whole, 44% of its 2.3 million km2 area is continental shelf, 13% continental slope, and 43% deepwater basin. A number of large bays, including Bristol and Kuskokwim Bays and Norton Sound on the Alaska coast, makes the coast line of the Bering Sea highly irregular. The area of all bays in the Bering Sea makes up 11.1% of the total area of the sea (Gershanovich 1963).

The broad eastern Bering Sea shelf is extremely smooth and has a gentle uniform gradient resulting from sediment deposits (Sharma 1974). The sediments, originating along the coast and transported offshore in graded suspension by storm waves, are predominantly sands over the inner shelf and silt and clay sediments on the other shelf and slope.

The continental slope bordering the eastern Bering Sea shelf is abrupt and very steep and is scoured with valleys and large submarine canyons (Sharma 1974).

Forming a partial barrier to the exchange of Bering Sea and Pacific Ocean water is the Aleutian-Commander Islands arc. This chain is made up of more than 150 islands and has a total length of approximately 2260 km (Gershanovich 1963). Shelf areas throughout most of the Aleutians portion of the chain are narrow (and frequently discontinuous between islands) ranging in width on the north and south sides of the island from about 4 km or less to 42-46 km. The shelf broadens in the eastern Aleutians.

An additional geographical feature of the Aleutian Islands region of fishery interest is Bowers Ridge. The submerged ridge, forming an arc off the west-central Aleutian Islands, is about 550 km long and 75-110 km wide, becoming even wider in the vicinity of the Rat Islands (Gershanovich 1963). The southern portion of the ridge summit is 150-200 m deep, the central portion is 600-700 m deep, and the northern portion 800-1000 m deep.

Exchange of water between the Bering Sea and the Pacific Ocean occurs through the various Aleutian Island passes with an estimated 14% of the Pacific water remaining in the Bering Sea (Sharma 1974). The net gain from Pacific water and surface runoff from rivers is lost to the Arctic Ocean through the Bering Strait, creating a net movement of water northward.

The dominant water movement on the eastern Bering Sea continental shelf originates from Pacific waters entering the Bering Sea in the vicinity of Unimak Island. These waters move northward toward St. Matthews Islands and eastward toward Bristol Bay. The northward stream divides near St. Matthews Island before joining again and passing through the Bering Strait.

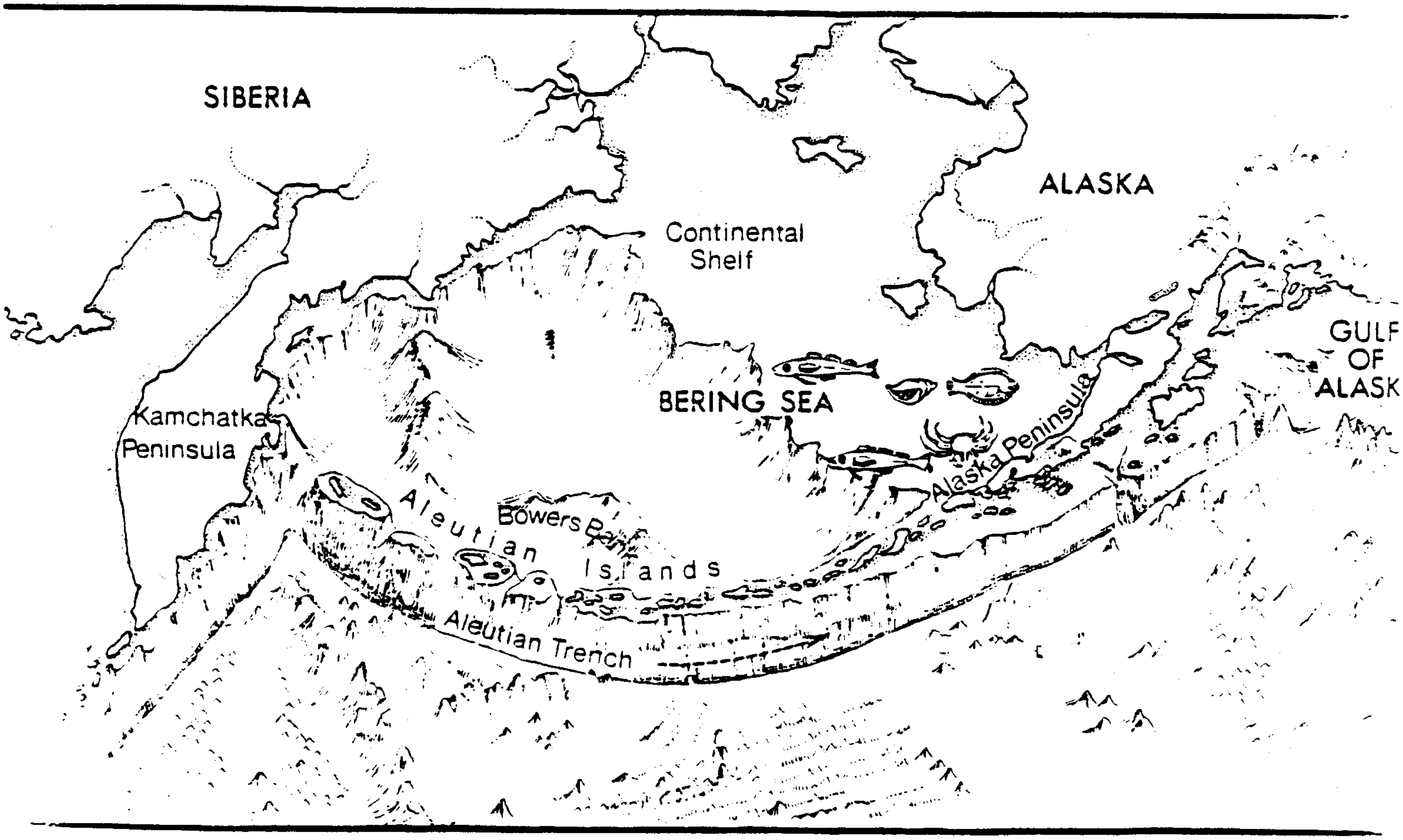

Figure 1.--Bottom features of Bering Sea and Aleutian Islands regions

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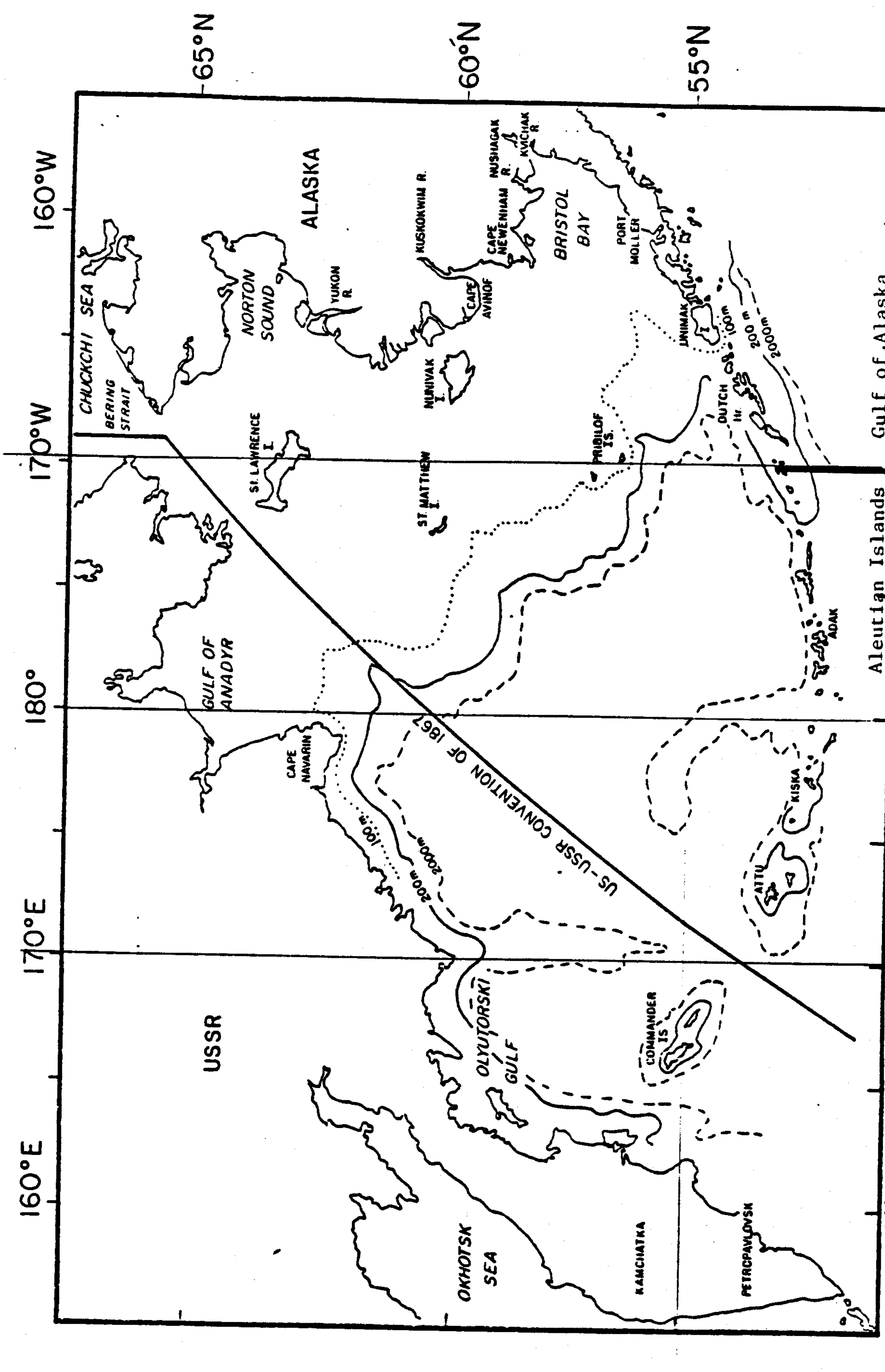

Figure 2.--Geographical locations in the eastern Bering Sea and Aleutian Islands.

The eastward flowing current along the Alaska Peninsula upon reaching the head of Bristol Bay is deflected westward by waters from the Kvichak and Nushagak Rivers (Sharma 1974). These westward flowing waters are mixed with Kuskokwim River water near the mouth of Kuskokwim Bay and directed southward, forming a cyclonic gyre in the southeastern Bering Sea.

The Bering Sea is influenced mainly by subarctic climate, except for the southernmost part, which can be included in the temperate zone (Sharma 1974). It lies in a region of moderate to strong atmospheric pressure gradients and is subject to numerous storms. A major environmental feature of the Bering Sea is the pack ice which covers most of the continental shelf in the eastern and northern sections of the sea in winter and spring. The ice edge begins to intrude into the northern Bering Sea in November, and normally reaches it maximum in late March (Potocsky 1975). At its maximum the ice pack may cover the continental shelf south to the Pribilof Islands and extend from the Pribilof Islands eastward to the vicinity of Port Moller. The areas of the outer shelf between the Pribilof Islands and Unimak Island and deeper waters of the Bering Sea are generally ice free throughout the year because of the intrusion of warmer Pacific Ocean water. In April and May the ice edge begins to retreat and by early summer the Bering Sea is normally free of ice.

The physical, climatic, and oceanographic features in the eastern Bering Sea combine to create conditions highly favorable for primary biological productivity. These conditions are only surpassed by some of the upwelling regions in the eastern Pacific and Atlantic Oceans (Hood and Kelly 1974). This productivity supports some of the largest fish, marine mammal, and bird populations in the world. Although the processes for this high productivity are not fully understood, they probably originate from the upwelling of nutrient-rich water along the Aleutian Islands chain (Sharma 1974), the mixing of Pacific Ocean and Bering Sea waters, the seasonable extremes in climate with a buildup of nutrients during the winter months (Gershanovich, et al 1974) and the expansive nature of the continental shelf.

5.1.2 Description of Stocks

The Bering Sea supports about 300 species of fishes, the majority of which are found near or on the bottom (Wilimovsky 1974). Among the pelagic species are the commercially important, or potentially important groups such as the salmon (Oncorhynchus), herring (Clupea), smelts (Osmerus), and capelin (Mallotus). The fish groups of primary concern in this plan are the bottom or near-bottom dwelling forms--the flounders, rockfish, sablefish, cod, pollock, and Atka mackerel. Although not bottom-dwelling, squids (Cephalopoda) are also included in the plan.

There is a general simplification in the diversity of bottomfish species in the Bering Sea compared to the more southern regions of the Gulf of Alaska and Washington to California. As a result, certain species inhabiting the Bering Sea are some of the largest bottomfish resources found anywhere in the world. In terms of biomass, the bottomfish community in the Bering Sea is much larger than its counterparts in other areas of the northeastern Pacific. The commercial production by all nations from the eastern Bering Sea/Aleutians has ranged from 1.6 to 2.3 million mt during the five-year period of 1971-1975, representing 69-86% of the groundfish catch for the entire region from the Bering Sea to California.

Relatively few roundfishes form aggregations in the eastern Bering Sea and Aleutian Islands areas large enough to attract target, or occasional target fisheries: Pacific cod, Pacific ocean perch, sablefish, Atka mackerel, and rattails (Table 1). A number of other rockfishes are taken while fishing for Pacific ocean perch, the most common of which are listed in Table 1.

Table 1. Commercially utilized demersal fishes in the eastern Bering Sea and Aleutian Island regions.

Common Name	Scientific name
TARGET SPECIES	
Pollock	Theragra chalcogramma
Pacific ocean perch	Sebastes alutus
Atka mackerel	Pleurogammus monopterygius
Sablefish	Anoplopoma fimbria
Yellowfin sole	Limanda aspera
Greenland turbot	Reinhardtius hippoglossoides
Pacific halibut	Hippoglossus stenolepis
OCCASIONAL TARGET SPECIES	
Pacific cod	Gadus Morhua Macrocephalus
Rock sole	Lepidopsetta bilineata
Flathead sole	Hippoglossoides elassodon
Arrowtooth flounder	Atheresthes stomias
Rattails	Coryphaenoides sp.
MINOR COMMERCIAL SPECIES 1/	
Rougheye rockfish	Sebastes aleutianus
Dusky rockfish	Sebastes ciliatus
Northern rockfish	Sebastes polyspinus
Shortspine rockfish	Sebastolobus alascanus
Shortraker rockfish	Sebastes borealis
Dark botched rockfish	Sebastes crameri
Yelloweye rockfish	Sebastes ruberrimus
Blue rockfish	Sebastes mystinus
Alaska plaice	Pleuronectes quadrituberculatus
Rex sole	Glytocephalus zachirus
Butter sole	Isopsetta isolepis
Longhead dab	Limanda proboscidea
Dover sole	Microstomus pacificus
Starry Flounder	Platichthys stellatus
Skates	Rajidae

1/ Includes species that may be marketable, but have low abundance.

In contrast to the relatively few species of commercially exploited roundfishes, the flatfish community of the Bering Sea is very diverse. Yellowfin sole dominates this group and has the longest history of intense exploitation by foreign fisheries. Other flounder species that are known to occur in aggregations large enough to form target species or occasional target species are Greenland turbot, Pacific halibut, rock sole, flathead sole, and arrowtooth flounder. Alaska plaice is also relatively abundant, but has not been intensively fished, apparently because of their low market value. A number of other flounders having commercial importance in regions to the south, also occur in the eastern Bering Sea (Table 1), but their abundance is low.

Elasmobranches (sharks and rays) which commonly occur off Washington to California, are relatively scarce in the eastern Bering Sea. Only skates (Rajidae) occur in significant quantities, but less so than in waters south of the Bering Sea.

Commercial catches illustrate the much greater magnitude of groundfish stocks in the eastern Bering Sea compared to the Aleutian Islands region (Figure 3). For the five-year period of 1971 to 1975, the all-nation commercial catch in the eastern Bering Sea averaged 2.0 million mt compared to only 59,000 mt in the Aleutian Islands. The major share of the catch in the eastern Bering Sea from 1971 to 1975 (1.6 million mt or 81%) was made up of pollock. Other roundfish contributed 8% to the average catch and flounders 11%. Roundfish also contributed the major share of the catch in the Aleutian Islands area (84%), but the principal roundfish species in the Aleutians region was Pacific ocean perch rather than pollock. Pollock catches in the Aleutians averaged only about 10,000 mt annually in 1971-1975.

The species make-up of catches in the two regions exclusive of pollock are illustrated in Figure 4. The data demonstrate that catches of both roundfish (other than pollock) and flounders were much greater in the eastern Bering Sea than in the Aleutians. Catches of flounders in the eastern Bering Sea were predominated by yellowfin sole (79,000 mt), but catches of Greenland turbot (71,000 mt) in this recent period has approached those of yellowfin sole. Rock sole, flathead sole, and arrowtooth flounders were other principal species of flounders taken in the eastern Bering Sea. Flounders form only an incidental part of the catch in the Aleutian Islands area with Greenland turbot the principal species in that area.

The principal roundfish in eastern Bering Sea catches after pollock was Pacific cod with an annual average catch in 1971-75 of 55,000 mt. The next most abundant species were Pacific ocean perch (17,000 mt) and sablefish (9,000 mt). The catch of "other groundfish" was also relatively high, averaging 69,000 mt annually, and forming 5.6% of the overall catch in the eastern Bering Sea. Although the species in this category were not identified, they most likely consist primarily of sculpins (Cottidae), eelpouts (Zoarcidae), skates (Rajidae), poachers (Agonidae) and rattails.

Pacific ocean perch have been the principal species of roundfish in Aleutian Islands catches and in 1971-75 annual catches have averaged 22,000 mt. Other than pollock (10,000 mt), the next most abundant species in catches were Atka mackerel (4,000 mt), sablefish (2,700 mt), and cod (1,500 mt).

Little is known about the extent of the squid resource in the eastern Bering Sea and Aleutian Islands area. The Japanese apparently target on squid to a limited degree. They took 4,300 mt and 5,900 mt in 1975 and 1976. Fishing was mainly in the Aleutian Islands area in 1975 and mainly in the eastern Bering Sea in 1976.

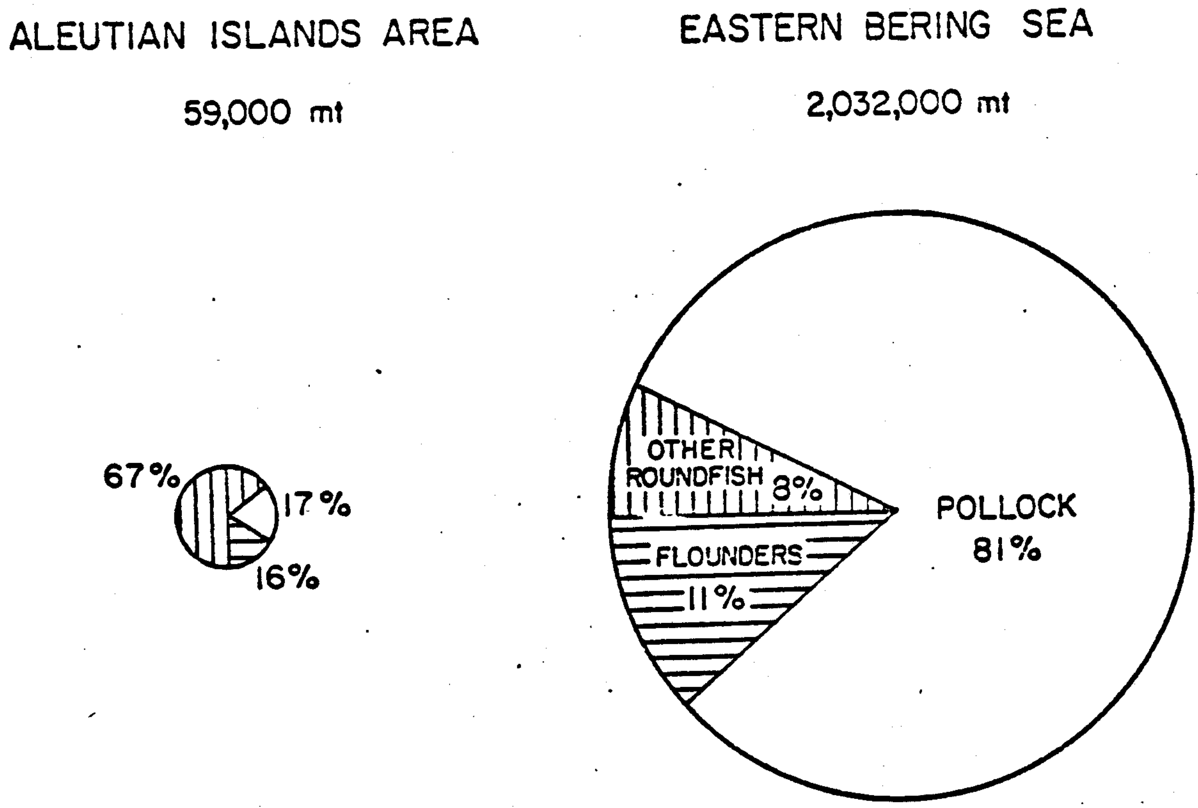

Figure 3.--Average annual catches of groundfish in the Aleutian Island area and the eastern Bering Sea, 1971-75.

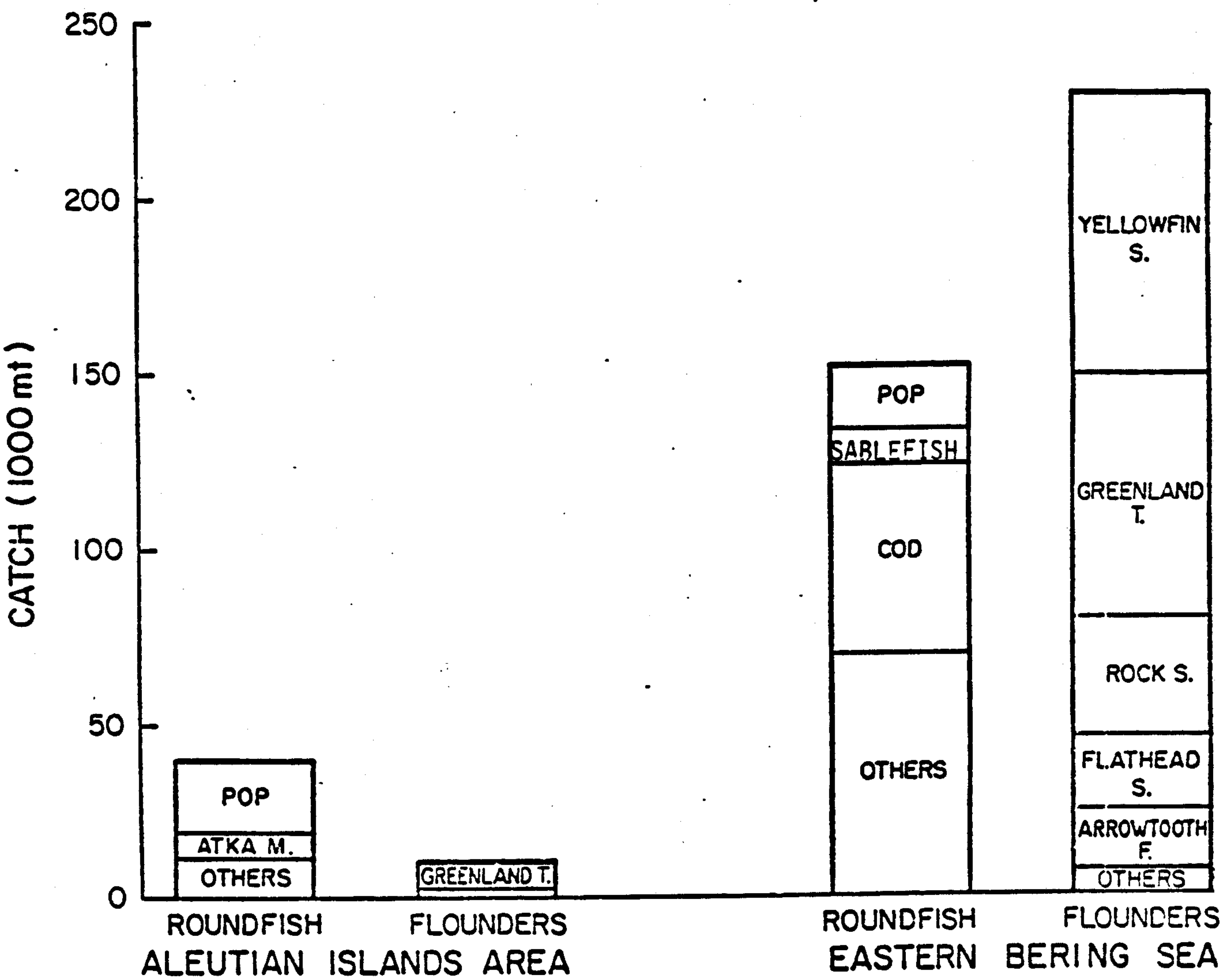

Figure 4.--Average annual catches of groundfish (excluding pollock) in the Aleutian Island area and eastern Bering Sea, 1971-75.

The depth distribution of principal commercial species varies by species and by season. Species of flounders that occupy the shallowest depths on the continental shelf (generally shallower than 100 m during summer) are yellowfin sole, Pacific halibut, rock sole, and Alaska plaice. The distribution of flathead sole is centered in deeper water than the above species, mainly occupying waters on the outer shelf (100-200 m), but also ranging onto the continental slope. The large flounders (Greenland turbot and arrowtooth flounder) occupy the deepest water with adults mainly located on the continental slope; they also occupy shelf waters, but mainly only the juvenile portion of the population.

In winter most of the flounders retreat to waters of the outer shelf and upper slope to avoid the subzero temperatures that extend over much of the eastern Bering Sea shelf in winter and early spring. These bathymetric migrations are most extensive for those flounders occupying the inner shelf in summer such as yellowfin sole, rock sole, Alaska plaice, and Pacific halibut. The migrations of Pacific halibut result in their occupying the greatest depth range of all flounders, extending from shallow bays to slope waters of over 500 m in depth.

Major commercial species of roundfish are mainly found on the outer shelf and slope. The distributions of pollock and Pacific cod are centered on the outer shelf in summer with some shifting to upper slope water in winter. Pacific ocean perch and other rockfishes are residents of the relatively deep water of the outer shelf and upper continental slope. Sablefish inhabit the deepest waters occurring to depths of perhaps over 1000 m.

5.2 History of Exploitation

5.2.1 Domestic Fishery

5.2.1.1 General Description of Fishery

The earliest fisheries for groundfish in the eastern Bering Sea and Aleutian Islands were the native subsistence fisheries. There were an important part of the life of native people, and dependence on demersal species of fish may have been critical to their survival in periods of the year when other sources of food were scarce or lacking. Fishing was in near-shore waters utilizing such species as cod, halibut, rockfish, and other species. These small-scale subsistence fisheries have continued to the present time.

The first commercial venture for bottomfish occurred in 1864 when a single schooner fished for Pacific cod in the Bering Sea (Cobb 1927). The cod fishery did not commence on a regular annual basis until 1882. This domestic fishery continued until 1950 when demand for cod declined and economic conditions caused the fishery to be discontinued (Alverson et al. 1964). Fishing areas in the eastern Bering Sea were from north of Unimak Island and the Alaska Peninsula to Bristol Bay (Cobb 1927). Vessels operated from home ports in Washington and California and from shore stations in the eastern Aleutian Islands. Canadian vessels also participated in the cod fishery to a limited extent.

The cod fishery reached its peak during World War I when the demand for cod was high. Numbers of schooners operating in the fishery ranged from 1-16 up to 1914 and increased to 13-24 in the period 1915-20. Estimated catches during the peak of the fishery ranged annually from 12,000-14,000 mt (Pereyra et al. 1976). Numbers of vessels in the fishery declined following 1920 until the fishery was terminated in 1950.

Halibut were reported as being present in the Bering Sea by United States cod vessels as early as the

1800s. However, halibut from the Bering Sea did not reach North American markets until 1928 (Thompson and Freeman 1930). Small and infrequent landings of halibut were made by United States and Canadian vessels between 1928 and 1950, but catches were not landed every year until 1952 (Dunlop et al. 1964). The catch by North American setline vessels increased sharply between 1958 and 1963 and then declined steadily until 1972. Since 1972, the catch has remained stable at a relatively low level. The decline in the catch was a result of reduced abundance which led to severe restriction on the fleet. The reduction in abundance was caused by a combination of factors: the North American setline fishery, the Japanese setline fishery, incidental catches of juvenile halibut in foreign trawl fisheries, and adverse environmental conditions. The relative importance of each of these factors is not clear at this time.

In the Aleutians, exploitation by the North American setline fishery is relatively low. There was no fishing before 1960 and since then catches have been less than 200 mt. However, stocks in this area are relatively small, and tagging studies indicate that they are an intermingling component of stocks in the Gulf of Alaska. Consequently, fish from this area should <u>not</u> be considered unexploited.

The number of Canadian and U.S. vessels is shown in Table 2, and the units of fishing effort have been summarized by Myhre et al. (1977) and IPHC (1977). In general, fishing effort in the Bering Sea was meager before 1958, increased sharply during the late 1950s and early 1960s, and then declined steadily until the early 1970s. Effort during the 1970s has been relatively low although a modest increase did occur in 1976 and 1977. The low effort during the 1970s is the result of reduced abundance and restrictions on the North American fleet.

Fishing effort in the Aleutians is very low because halibut stocks are relatively small and the distance to major ports is long.

Present participation by North American nationals in commercial fisheries for bottomfish in the Bering Sea and Aleutian Islands is confined mainly to the relatively small longline fishery for halibut by United States and Canadian fishermen. Some crab vessels may also fish bottomfish occasionally for use as crab bait. A brief, one-vessel exploratory effort occurred for sablefish in the southeastern Bering Sea in 1977. The native subsistence fishery mainly utilizes non-demersal species such as herring and salmon.

5.2.1.2 <u>Description of Vessels and Gear</u>

The domestic cod fishery was carried out mainly to sailing schooners ranging in length from 30-46 m and equipped for dory fishing (Alverson et al. 1964). The dories were approximately 4 m in length and operated by a single fisherman using handlines to take cod.

Most of the halibut fishing vessels are schooners or seine-type vessels that are over 30 net tons and land their catch in major ports. Smaller vessels out of Unalaska and Adak also fish halibut but these vessels account for less than 10% of the total landings. There is also a small subsistence fishery in the Pribilof Islands and a few other locations, but little is known about the vessels or catch involved.

The halibut vessels use setline gear which consists of a longline on which branchlines (gangions), each with a hook, are attached at regular intervals, usually about every 6-8 meters. A unit of setline gear is called a "skate" and is about 550 m in length. The gear is left on the bottom for periods from 4 to 30 hours (soaking time). Fishing usually is conducted at depths between 90 and 275 m, but may The vessels and gear used in the Aleutians are similar to those in the Bering Sea although the amount of effort is much less.

Table 2. Number of U.S. and Canadian vessels over 5 net tons that fished halibut in the Bering Sea, 1930-1977.

Year	United States	Canada
1930	3	-
1931	8	-
-	-	-
1933	1	-
-	-	-
1945	1	-
-	-	-
1950	1	-
-	-	-
1952	9	-
1953	6	-
1954	2	-
1955	1	-
1956	3	2
1957	1	-
1958	7	14
1959	19	20
1960	35	31
1961	34	27
1962	43	33
1963	51	53
1964	36	32
1965	19	15
1966	4	11
1967	17	19
1968	11	17
1969	7	16
1970	6	13
1971	4	13
1972	6	9
1973	7	3
1974	6	1
1975	8	3
1976	10	1
1977	19	1

5.2.1.3 Catch Trends

The numbers of vessels used and estimated catches in the eastern Bering Sea during the history of the domestic cod fishery are given in Table 3. The catches shown in Table 3 are estimates for the Bering Sea in metric tons roundweight as given by Pereyra et al. (1976). The estimates are based on weights of processed products from Cobb (1927) and Bower (1927-53). As indicated by Pereyra et al. (1974) the catches should be considered as approximations because of some uncertainty about the conversion factors used and some portion of the catches may have originated from the Gulf of Alaska.

Numbers of vessels in the cod fishery and estimated catches reached their peak during World War I when the demand for cod was high. During the period of 1915-19, estimated catches ranged from about 12,000 to 14,000 mt. Following this period, catches declined until termination of the fishery in 1950.

Estimated peak catches of cod in the domestic fishery are relatively small when contrasted with those from the recent foreign fisheries in the eastern Bering Sea which have ranged over 50,000 mt in some years.

Table 4 shows the annual catch of halibut in the Bering Sea and Aleutian areas by Canadian and U.S. fishermen from 1930 to 1977. In the Bering Sea, the annual catch was less than 200 mt before 1958, but then rose sharply to about 4,900 mt in 1963. The catch then declined steadily to a low of 173 mt in 1973. Since then, the catch has increased slightly and was about 450 mt in 1977. The decline in catch since 1963 was the result of reduced abundance and restrictions on the fishery. In years of high production, the catch was split about evenly between Canadian and U.S. vessels although since 1972 the U.S. share has been larger.

There was no catch reported in the Aleutian area before 1960. Until 1976, annual catches fluctuated between 1 and 67 mt; in 1977 preliminary data indicate a catch of 178 mt.

5.2.2 Foreign Fishery

5.2.2.1 General Description of Fisheries

Nationals from six foreign countries have conducted groundfish fisheries in the eastern Bering Sea and Aleutian Islands. One of these, the Canadian halibut fishery, was previously described under the domestic fishery because of its small size and similarity to the U.S. fishery for halibut. Of the other foreign fisheries, Japan has had the longest history of exploitation in the region and has mounted the greatest effort over the years. The first documented fishery for demersal species by the Japanese in the eastern Bering Sea dates back to an exploratory effort in 1930. This was followed by a relatively small-scale fishery which had its origin in 1954. Excluding Canada, the second foreign nation to send demersal fishing fleets to the eastern Bering Sea and the nation having the second largest removals of groundfish in the region has been the USSR. Their fisheries commenced in 1958.

In 1966 a trawler from the Republic of Korean (ROK) explored fishing grounds in the eastern Bering Sea and Aleutian Islands. A commercial operation followed in 1967 but the number of vessels and magnitude of the catch by ROK fishermen has remained much smaller than that by Japan and the USSR. The Republic of China (Taiwan) has also had a fishery in the eastern Bering Sea since late 1974, but involving only one or two trawlers.

Table 3. Estimated catches of Pacific cod in the eastern Bering Sea, 1864, 1882-1950 1/ (from Pereyra et al. 1976).

Year	Number Vessels	Estimated 2/ Catch	Year	Number Vessels	Estimated 2/ Catch
		(mt)			(mt)
1864	1	23	1915	13	12,016
			1916	13	13,947
1882	2	673	1917	16	13,946
1883	5	1,944	1918	17	12,719
1884	3	1,867	1919	17	12,140
1885	3	1,510	1920	24	8,567
1886	2	1,219	1921	6	3,102
1887	1	944	1922	10	5,923
1888	2	1,500	1923	17	8,951
1889	0	0	1924	15	9,889
1890	1	245	1925	14	10,489
1891	6	2,102	1926	7	9,924
1892	6	3,316	1927	7	6,887
1893	4	1,658	1928	8	7,083
1894	5	2,699	1929	9	7,851
1895	5	2,638	1930	8	7,647
1896	7	3,633	1931	4	4,314
1897	8	4,337	1932	5	4,692
1898	4	1,745	1933	5	5,779
1899	7	3,995	1934	7	6,361
1900	8	4,168	1935	5	5,713
1901	7	4,015	1936	5	5,008
1902	12	6,270	1937	4	4,885
1903	10	6,116	1938	3	3,963
1904	11	6,400	1939	3	3,960
1905	16	8,654	1940	4	4,129
1906	11	7,758	1941	3	2,940
1907	9	6,216	1942	1	814
1908	11	7,643	1943	0	0
1909	12	8,511	1944	1	656
1910	9	6,589	1945	1	639
1911	10	7,867	1946	2	997
1912	9	5,485	1947	2	1,041
1913	9	6,180	1948	1	1,006
1914	13	9,817	1949	1	950
			1950	1	668

1/ Original catch data in numbers of fish for 1864, 1882-1925 from Cobb (1927) and weight of cured products for 1926-1950 from Bower (1927, 1953) are converted to round weight in metric tons from conversion factors provided by Cobb (1927).

2/ Catches for 1916 to 1925 also include offshore catches from the North Pacific Ocean.

Table 4. Catch of halibut by Canadian and U.S. vessels in the Bering Sea and Aleutian areas, 1930-1977. Catch in metric tons, round weight.

Year	Bering Sea Canada	Bering Sea U.S.	Bering Sea Total	Aleutian Canada	Aleutian U.S.	Aleutian Total
1930	-	62	62	-	-	-
1931	-	62	62	-	-	-
-	-	-	-	-	-	-
1933	-	11	11	-	-	-
-	-	-	-	-	-	-
1945	-	3	3	-	-	-
-	-	-	-	-	-	-
1952	-	152	152	-	-	-
1953	-	137	137	-	-	-
1954	-	24	24	-	-	-
1955	-	27	27	-	-	-
1956	51	107	158	-	-	-
1957	-	24	24	-	-	-
1958	731	582	1,313	-	-	-
1959	1,442	1,065	2,507	-	-	-
1960	2,016	1,392	3,408	10	-	10
1961	1,163	1,231	2,394	-	-	-
1962	2,113	2,304	4,417	-	12	12
1963	2,886	2,022	4,908	38	-	38
1964	758	647	1,605	-	1	1
1965	356	449	805	-	-	-
1966	385	336	721	45	-	45
1967	668	776	1,444	-	9	9
1968	402	395	797	5	-	5
1969	404	340	744	-	53	53
1970	536	148	684	33	32	65
1971	440	83	523	-	1	1
1972	149	293	442	7	12	19
1973	58	115	173	28	-	28
1974	101	162	263	60	3	63
1975	102	215	317	3	-	3
1976	37	278	315	56	11	67
1977*	84	366	450	162	16	178

*preliminary

Polish vessels fished briefly in the eastern Bering Sea in 1973 (Law Enforcement Division 1975). Since then, Poland has agreed to abstain from further fishing in the eastern Bering Sea. Although allowed to fish in certain waters of the Aleutian Islands, Polish vessels have not operated there.

5.2.2.1.1 Japanese Fishery

Following the initial exploratory effort by two trawlers in 1930, the Japanese returned to the eastern Bering Sea with a mothership-catcher boat operation in 1933 (Forrester, et al. 1974). The fleet was composed of an 8,000 ton mothership and several catcher boats including 400 gross ton side-trawlers and 88 gross ton pair trawlers. Fishing was off Bristol Bay with the emphasis on pollock for the production of fish meal. The catch was processed aboard the mothership and transported back to Japan aboard transport vessels. This fishery continued to operate until 1937 when prices of fish meal declined causing the fisheries to terminate. Catches in this period ranged up to 43,000 mt with pollock the major species taken.

A second mothership-type operation was conducted in the eastern Bering Sea by Japan in 1940-41 (Forrester, et al. 1974). Target species was yellowfin sole that were frozen for human consumption. Catches in the two-year period ranged from 9,600 to 12,200 mt (Table 5).

With the signing of the peace treaty between the United States and Japan in 1952, restrictions on Japanese distant-water fisheries were removed, and in 1954, fishing in the eastern Bering Sea was resumed. The Japanese post-war fishery for groundfish developed into several components, the four principal ones being the mothership fishery, North Pacific trawl fishery, North Pacific longline-gillnet fishery, and the landbased trawl fishery.

The number of mothership fleets and number of vessels in the other fisheries are given in Table 6 along with a description of each type of fishery in the accompanying footnotes. As shown in Table 6, the mothership fishery can be divided into four additional types depending on the target species and processing methods. These are the freezing fleets which targeted on flounders in the period 1954-60; the freezing fleets operating since 1960 that continued to target on flounders, but also targeted on other species, the meal and minced fish fleets which originally took flounders for fish meal, but since 1964 have targeted on pollock for the production of minced fish, as well as fish meal and the longline-gillnet fleet which took halibut, cod, sablefish and herring for freezing.

The mothership fishery has accounted for the largest share of the Japanese catch in the Bering Sea since 1954. In the recent period of 1971-76 the mothership fishery took 64% of the total catch, the North Pacific trawl fishery 31%, the land-based fishery 5%, and North Pacific longline-gillnet fishery 0.3% (Sasaki 1977).

Mothership fishery.--Forrester et al. (1974) divided the history of the mothership fishery into three periods based on target species, methods of processing catches, and expansion of fishing grounds.

In the first period (1954-57), the fishery was relatively small involving two to four 8,000 gross ton motherships of the freezer-factory ship type and trawlers of the 200-300 ton class as catcher boats. The fleets operated for about one month between August and October between the salmon driftnet and Antarctic whaling seasons. Fishing was off Bristol Bay and the catch, consisting of flounders (primarily yellowfin sole) was frozen.

Table 5. Number of Japanese vessels operating in the eastern Bering Sea and their catches, 1933-37 and 1940-41 (from Forrester et al., 1974).

Year	Number of fleets	No. of catcher boats			Catch (metric tons)			
		Total	Trawl	Pair trawl	Total	Flat fishes	Pacific pollock	Other fishes
1933	1	5	5	-	3,300	?	?	?
1934	1	5	5	-	14,953	1,385	11,645	1,923
1935	1	11	3	8	28,629	2,869	23,553	2,207
1936	1	8	4	4	26,622	1,003	23,000	2,610
1937	1	13	3	10	43,383	9,310	31,316	2,757
1940	1	8	-	8	9,577	6,941	24	2,612
1941	1	12	4	8	12,226	9,839	1,287	1,100

Table 6. Number of fleets in the Japanese mothership fishery and number of vessels in the Japanese North Pacific Trawl and longline-gillnet fisheries and landbased trawl fishery (data from Forrester et al. 1974; Yamaguchi 1974, 1975; Saski 1977).

Year	fleet1/ for flounders only	fleet2/ (including other than flounders)	Meal and mince-fleet3/	line-gill-net fleet4/	Total	Pacific trawl Fishery5/	North Pacific longline-gillnet Fishery6/	Land-based trawl Fishery7/
1954	2	--	--	--	2	2	--	--
1955	2	--	--	--	2	3	--	--
1956	4	--	--	--	4	1	--	--
1957	4	--	--	--	4	--	--	--
1958	2	--	1	1	4	--	--	--
1959	4	--	1	1	6	2	--	--
1960	3	1	5	4	13	--	--	--
1961	--	13	5	14	32	3	--	54
1962	--	11	5	5	21	2	--	70
1963	--	10	2	5	17	2	--	93
1964	--	6	4	2	12	2	--	103
1965	--	6	4	2	12	2	--	126
1966	--	8	4	1	13	2	--	172
1967	--	7	5	2	14	42	22	173
1968	--	6	5	1	12	42	22	184
1969	--	5	5	1	11	42	21	182
1970	--	3	6	1	10	42	22	182
1971	--	5	6	1	12	42	22	182
1972	--	4	6	8/	10	42	22	182
1973	--	4	6	--	10	42	26	182
1974	--	4	6	--	10	42	30	182
1975	--	3	5	--	8	35	27	182
1976	--	3	5	--	8	54	32	182

1/ Flounder fleet: The fleets, each composed of a mothership of 7,000-9,000 tons, equipped with freezing facilities and having several 300-ton class trawlers attached to it, caught mainly yellowfin sole for freezing off Bristol Bay.

2/ Freezing fleet: The fleets, each composed of a mothership of 5,000-10,000 tons with freezing equipment, accompanied by trawlers as well as Danish seiners, which also fished longlines and gillnets, caught halibut, blackcod, herring, Pacific ocean perch, Navarin, in the Gulf of Olyutorskii, and in Aleutian waters.

Table 6. -- (continued)

3/ Fish meal (minced fish fleet): The fleets, each composed of a mothership of 9,000-14,000 tons, equipped with fish-meal plants, accompanied by 2-30 pair trawlers and Danish seiners, caught yellowfin sole on the eastern Bering Sea flats, and turbot along the continental slope in the eastern Bering Sea for production of fish meal. From 1964, the fleet switched to production of minced fish with a minced-fish plant, utilizing pollock caught in the eastern Bering Sea. The fleet also has freezing facilities and produces frozen fish.

4/ Longline-gillnet fleet: The fleets, each composed of a small mothership of 200-2,500 tons, accompanied by gillnetters and longliners, caught halibut, cod, blackcod, and herring to be frozen. The fishing grounds were along the continental slope from the Pribilof Islands and Cape Navarin-Gulf of Olyutorskii.

5/ North Pacific trawl fishery: This fishery is conducted by independent large trawlers, and the catch is frozen on board. The number of trawlers larger than 3,000 tons engaged in this fishery, on board which minced fish and fish meal are produced, has increased since 1968/ Transport vessels were not used in this fishery until 1966. However, since 1967 a considerable number of transport ships have been used to carry products of this fishery. The figures for 1967 and thereafter indicate the numbers of vessels licensed for this fishery.

6/ North Pacific longline-gillnet fishery: This fishery is conducted by independent longline-gillnetters, and the catch is processed on board. When filled with frozen products they return to their based in Japan. The numbers of vessels in this table are the numbers licensed annually for this fishery.

7/ Landbased trawl fishery: This fishery consists of independent operations by Danish seiners and stern trawlers of 100-350 tons. The vessels process the catch on board, produce frozen goods, and return to Japan when they are filled. Extensive areas, including the Okhotsk Sea and waters around the northern Kurile Islands, are permitted for their operation. The number of vessels operated in the Bering Sea is not known. The figures in this table indicate the number of vessels licensed.

8/ From 1972-76 these fleets are included in the freezing fleets.

In the second period (1958-63), the fishery expanded throughout the Bering Sea with diversification of fishing methods and target species (Table 6). Fish meal operations were initiated in 1958 utilizing flounders in the eastern Bering Sea which were processed by 9,000 gross ton motherships operating from April to September. Each mothership was supplied with fish by 20 Danish seiners and pair trawlers. The freezing fleets described in the previous period also continued to fish and catches of yellowfin sole reached their peak in this period, ranging between 420,000 and 554,000 mt annually in 1960-62 including catches by the USSR.

Another mothership operation beginning in the 1958-63 period was the longline-gillnet fishery consisting of 500 gross ton motherships and 100 gross ton longliners. These vessels fished for halibut and sablefish for freezing along the continental slope off Cape Navarin starting in 1958. In 1960 they began fishing operations for Pacific ocean perch along the continental slope between the Pribilof Islands and Cape Navarin and in 1963 expanded their area of operations to Bowers Banks off the Aleutian Islands.

The fleets involved in the yellowfin sole fishery for freezing also extended their operations to include halibut, sablefish, and Pacific ocean perch and together with the longline-gillnet fleets expanded their area of operations to the continental slope in the central and northern Bering Sea and to Aleutian Islands waters. The fishing season which had previously been about one month was lengthened to four to nine months and winter fishing was initiated in 1961-62.

The third period (1964 to present) is characterized by the development of the pollock fishery. With the decline in abundance of yellowfin sole (due to overfishing in the early 1960s), and the development in 1964 of techniques for processing minced fish (surimi) on-board motherships, the main Japanese effort shifted to pollock. Fish meal and frozen products became a by-product of these operations. Pollock has dominated Japanese catches since 1962 and from 1971-76 has formed over 80% of the total Japanese groundfish catch in the eastern Bering Sea and Aleutian Islands area. The pollock fishery has become a year-round effort while the flounder fishery principally for yellowfin sole became a winter fishery in 1969-70 with the season generally lasting from October to March. Catcher boats in the mothership fishery have been pair trawlers, Danish seiners, side-trawlers, and stern trawlers. Side-trawlers have been phased out of the fishery and the number of Danish seiners has declined with pair trawlers becoming the mainstay of the fleet.

The winter fishing grounds for flounders were mainly north of Unimak Island and occasionally west and east of the Pribilof Islands. The major fishing grounds for pollock have been along the outer continental slope and upper slope from Unimak Pass northwestward toward Cape Navarin. Typical fishing areas of the mothership fishery are shown in Figure 5.

North Pacific trawl fishery.--This second major type of Japanese fishery consists of independent factory trawlers larger than 500 tons that both fish and process their own catch (Forrester et al. 1974). Products are minced fish, frozen fish, and fish meal. The products are transshipped to Japan by refrigerated transport.

In the initial period of this fishery (1954-59), one to three independent trawlers fished in the eastern Bering Sea for yellowfin sole. Since 1961 they have also exploited (for freezing) halibut, sablefish, Pacific ocean perch, and other species along the continental slope in the central and northern Bering Sea and in Aleutian Island waters. In 1967 the number of licenses issued for independent trawlers was increased to 42 and has ranged from 35 to 54 in later years (Table 6). Greater numbers of larger trawlers in the 3,000-5,000 ton class (equipped with machinery for producing surimi) resulted in a rapid increase in the pollock catch by this fishery. By 1970, 80% of the total groundfish catch by these vessels was pollock.

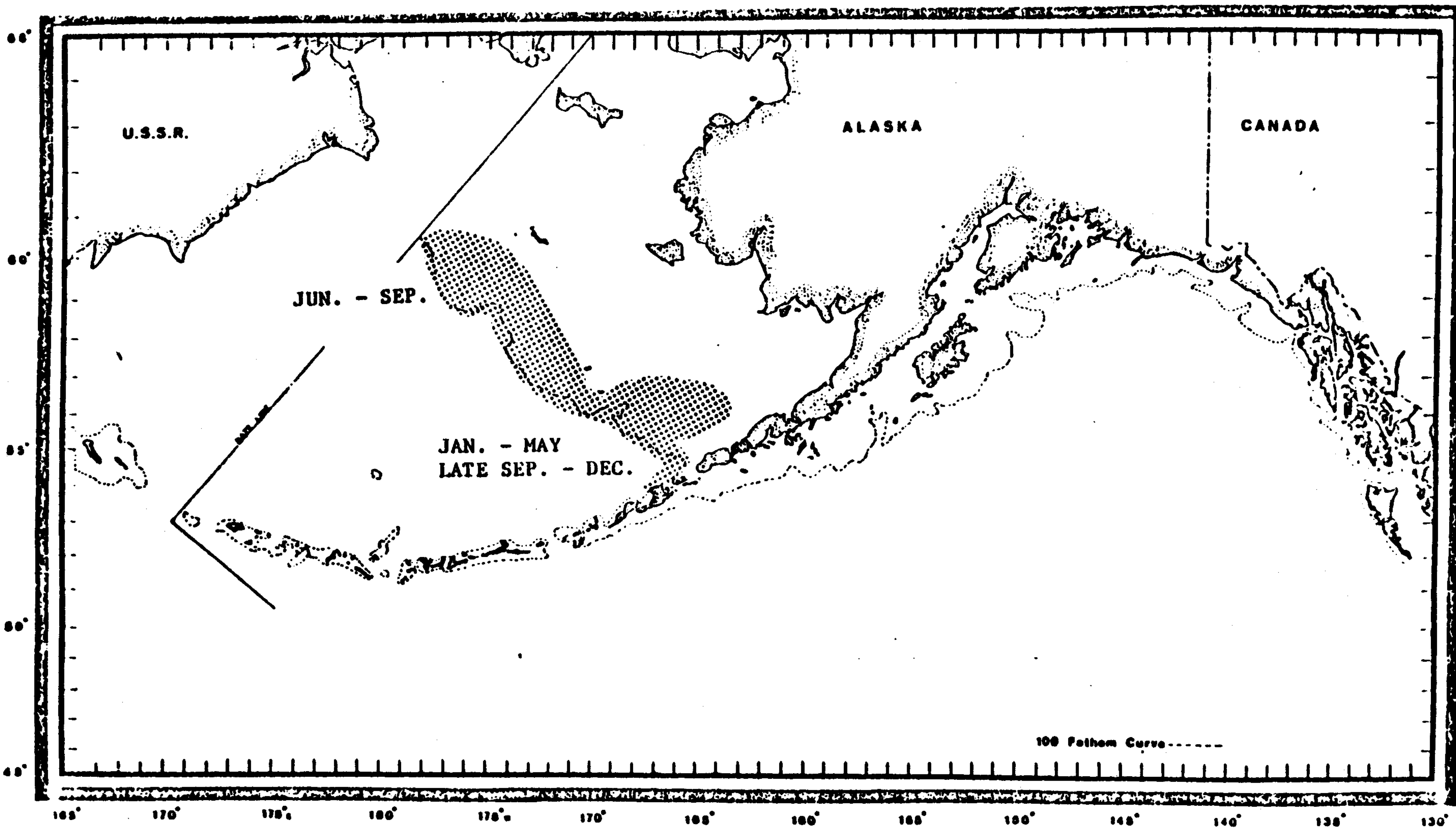

Figure 5.--Areas fished by the Japanese mothership fleets in 1972 (from Law Enforcement Division 1974).

The main effort by the independent trawlers is in the eastern Bering Sea where year-round operations are conducted for pollock. Other species taken are cod and various flounders. The number of vessels generally increase from a low in mid-winter to a peak in summer involving from 20 to 40 trawlers (Enforcement and Surveillance Division 1971 and 1973; Law Enforcement Division 1974, 1975, and 1977).

In the Aleutian Islands the trawlers target on Pacific ocean perch and take lesser amounts of pollock and various other groundfish. Fishing in the Aleutians is concentrated along the shelf edge in the central and western part of the chain with some effort in the eastern Islands. Maximum effort is in summer or early fall with the number of vessels reaching 7 to 18 in peak months (Enforcement and Surveillance Division 1971 and 1973; Law Enforcement Division 1974, 1975, and 1977).

Areas of the fishery are illustrated in Figure 6.

North Pacific longline-gillnet fishery.--Herring and sablefish are the principal species taken by this fishery. The vessels operate independently, and when filled with fresh fish or frozen products, return to Japan. From 1963 to 1966 there were 18-19 vessels licensed in this fishery to operate north of 50°N and between 170°E and 170°W, but records of the number of vessels actually operating, the areas of operation, and the species taken are not available (Forrester et al. 1974).

In 1967 the number of longline-gillnet vessels licensed was increased to 22. Fishing by these 200-500 gross ton vessels has mainly been in the northeastern Pacific ocean where the catch was almost exclusively sablefish with some rockfish taken. The vessels operate year-round and normally remain on the grounds for two to four month periods until their hold capacity of about 400 mt is reached (Law Enforcement Division 1974).

Fishing for sablefish in the eastern Bering Sea and along the Aleutian Islands by the North Pacific longline vessels has been sporadic with only a few vessels fishing briefly each year. The areas of fishing in these regions as well as in the Gulf of Alaska in 1974 are shown in Figure 7.

Landbased trawl fishery.--This fishery, conducted by independent trawlers of 100-350 tons are prohibited by regulation from transshipping their catch in offshore waters (Forrester et al. 1974) and therefore return to Japan when storage capacity is filled. Their catches are chiefly flounders, Pacific ocean perch, and sablefish. When initiated in the early 1960's, the fishery was restricted to waters north of 48°N and between 153°E and 170°E. In June 1963 the area was expanded eastward to 175°W and in September 1967 to 170°W. Major fishing grounds are along the continental slope from Cape Olyutorskii to Cape Navarin and off the Pribilof Islands. Gear consisted mainly of Danish seines early in the fishery but stern trawls became the major gear in later years. From the 54 vessels licensed to operate in the fishery in 1961, the number grew to 184 in 1968 and has been 182 since 1969 (Table 6). The number of licensed vessels actually operating in this fishery is unknown.

5.2.2.1.2 Soviet Fishery

The first commercial-scale operations by the USSR off Alaska, following exploratory work in 1957-58, was a fishery for flounders in the eastern Bering Sea starting in 1959 (Chitwood 1969). Like the Japanese, the Soviets have expanded their fisheries since its inception in terms of effort, target species, and fishing areas. There have been three major groundfish fisheries in the eastern Bering Sea and Aleutian Islands: a flounder fishery in the southeastern Bering Sea, a rockfish fishery primarily in the Aleutian Islands, and a pollock fishery along the outer continental shelf from Unimak Pass to northwest of the Pribilof Islands. In describing these fisheries, information is used from

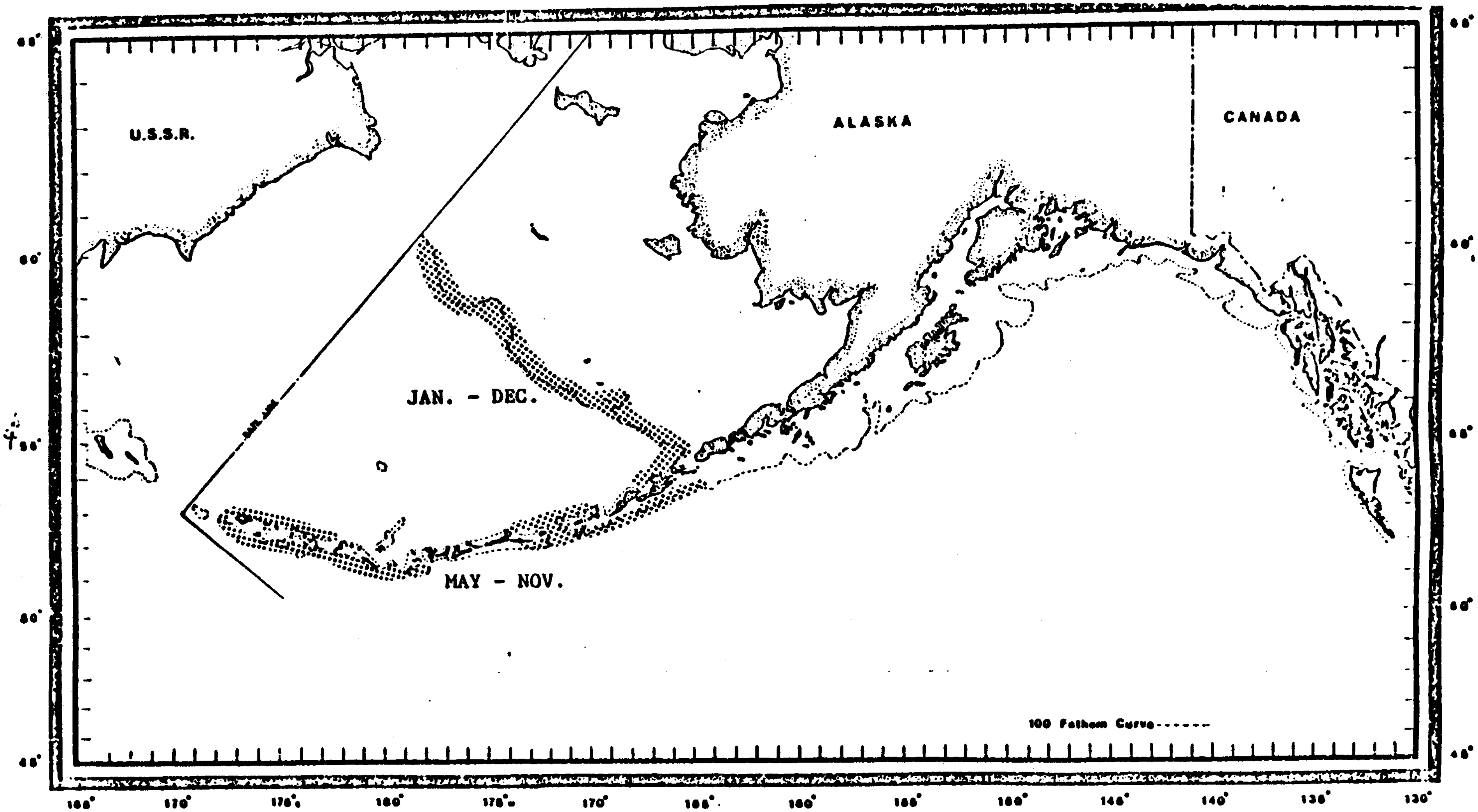

Figure 6.--Areas of the eastern Bering Sea and Aleutian Islands fished by the Japanese North Pacific trawl fishery (Law Enforcement Division 1974).

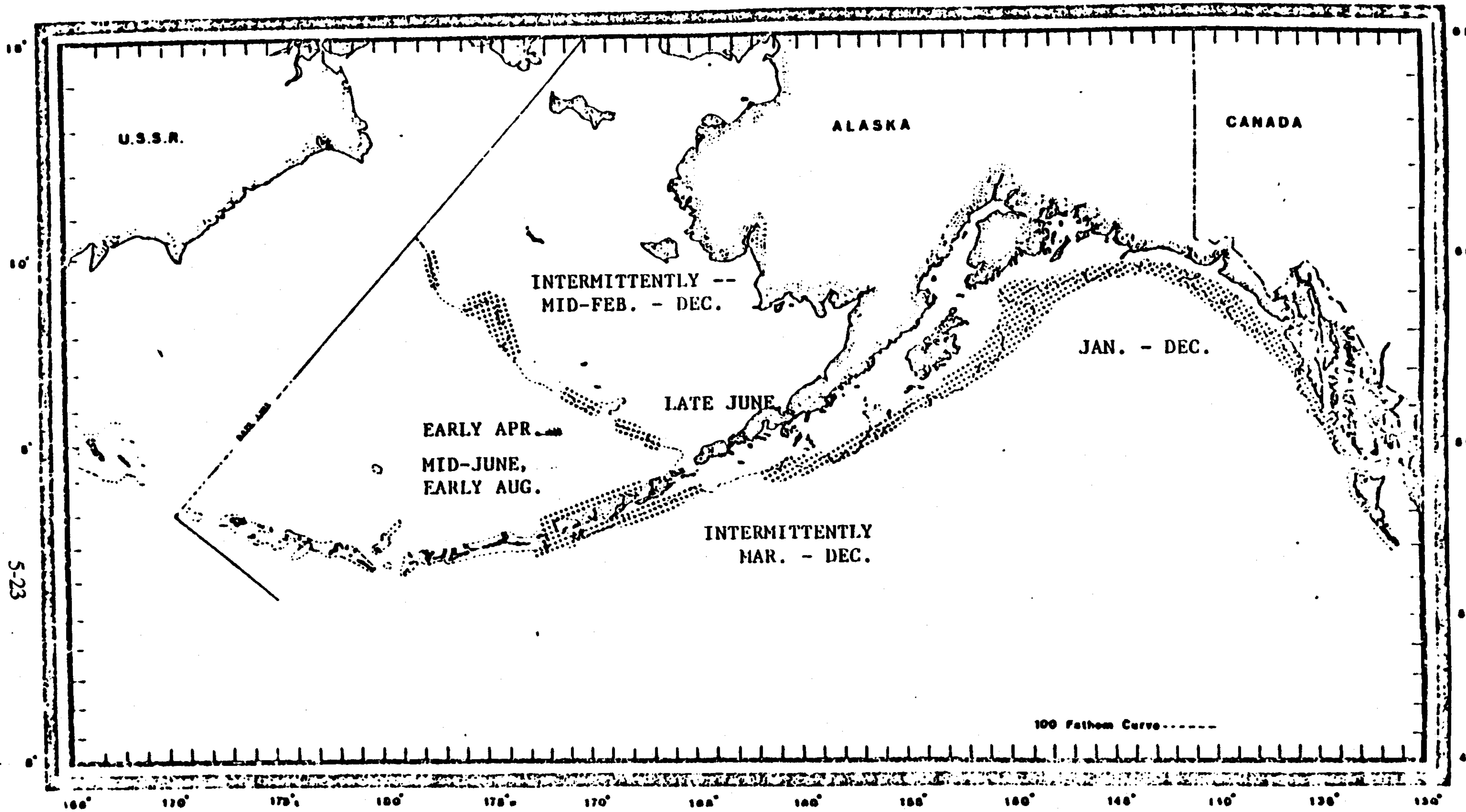

Figure 7.--Areas fished by Japanese North Pacific longline vessels in 1974 (Law Enforcement Division 1977).

Chitwood (1969), Forrester et al. (1974), Haskell (1964), Office of Enforcement and Surveillance (1965, 1967-70), Enforcement and Surveillance Division (1971, 1973), and Law Enforcement Division (1974, 1975, 1977).

Flounder fishery.--The Soviet flounder fishery was a winter operation throughout its history extending usually from November to April and peaking in February or March. The fishing grounds (Figure 8) were in areas where aggregations of yellowfin sole and other flounders form in winter after migrations from shallower waters of the inner shelf. The primary target species was yellowfin sole which comprised a high proportion of the catches with other flounders such as rock sole, flathead sole, Alaska plaice, starry flounder, and arrowtooth flounder making up most of the remainder. Vessels participating in this fishery have ranged from smaller side trawlers (SRT) to medium (SRTM) and large independent stern trawlers (BMRT) and support vessels (see Section 5.2.2.2 for description of vessel types). Side trawlers delivered this catches to factory ships or processing refrigerated transports, which froze the fish for later transport to the Soviet Union. The larger trawlers freeze their own catches.

The first few years of the Soviet flounder fishery (1959-63) involved about 30 trawlers supported by a factory ship and refrigerated transport vessels. Catches in that period probably ranged between 60,000 and 155,000 mt. In the next three years effort was increased in this fishery with the number of trawlers rising to 40 in 1964, 50-60 in 1965, and 70-100 in 1966. The fishery peaked in terms of numbers of trawlers from 1966 and 1968 with the maximum number reaching 70-100 in the peak months of fishing in January, February or March. In those peak years, the flounder fishery represented the largest effort by the Soviets in Alaskan waters.

Starting in 1969, the Soviet effort for flounders generally declined, presumably because abundance of yellowfin sole was lower than in previous years. The numbers of vessels in peak months decreased to between 50 and 80 in 1969-72. Although a peak of 70 vessels fished in 1972, there was a sharp drop in catches of flounders to about 13,000 mt from over 70,000 mt or more in the previous three years. In 1973 the flounder fishery failed to develop. Effort was limited to a two-week period by four trawlers. The Soviets have not resumed this fishery to the present time.

Pacific ocean perch fishery.--The Soviet fishery for Pacific ocean perch and other rockfish began in 1960 when 25 to 30 trawlers fished along the edge of the continental shelf in the eastern and central Bering Sea. In subsequent years the fishery became centered in the Aleutian Islands and Gulf of Alaska (Figure 9). The Aleutian Islands fishery has been mainly by larger BMRT factory trawlers fishing along the continental shelf edge at depths of about 15-280 m. Catches were headed, eviscerated, and frozen until transferred to refrigerated transport vessels for delivery to the Soviet Union.

Following concentration of effort for Pacific ocean perch in the Aleutians and Gulf of Alaska in 1963, directed effort to Pacific ocean perch in the eastern Bering Sea decreased and was eventually eliminated. Catches from this region in later years were a by-catch of the pollock fishery. The early years of the Aleutian Islands fishery were the most productive with reported catches of 61,000 mt in 1974 and 71,000 in 1965. Although the catch increased in 1965, the catch per trawler declined and search time for concentrations of perch increased substantially.

Whereas the fishery was continuous through 1965, effort in 1966 was sporadic, apparently because of reduced abundance of rockfish. The effort in 1967 and 1968 was approximately the same as in 1966 with fishing starting in spring months and continuing through the end of the year. In 1969 there was further reduction in effort with only one-half to two-thirds the number of vessels fishing

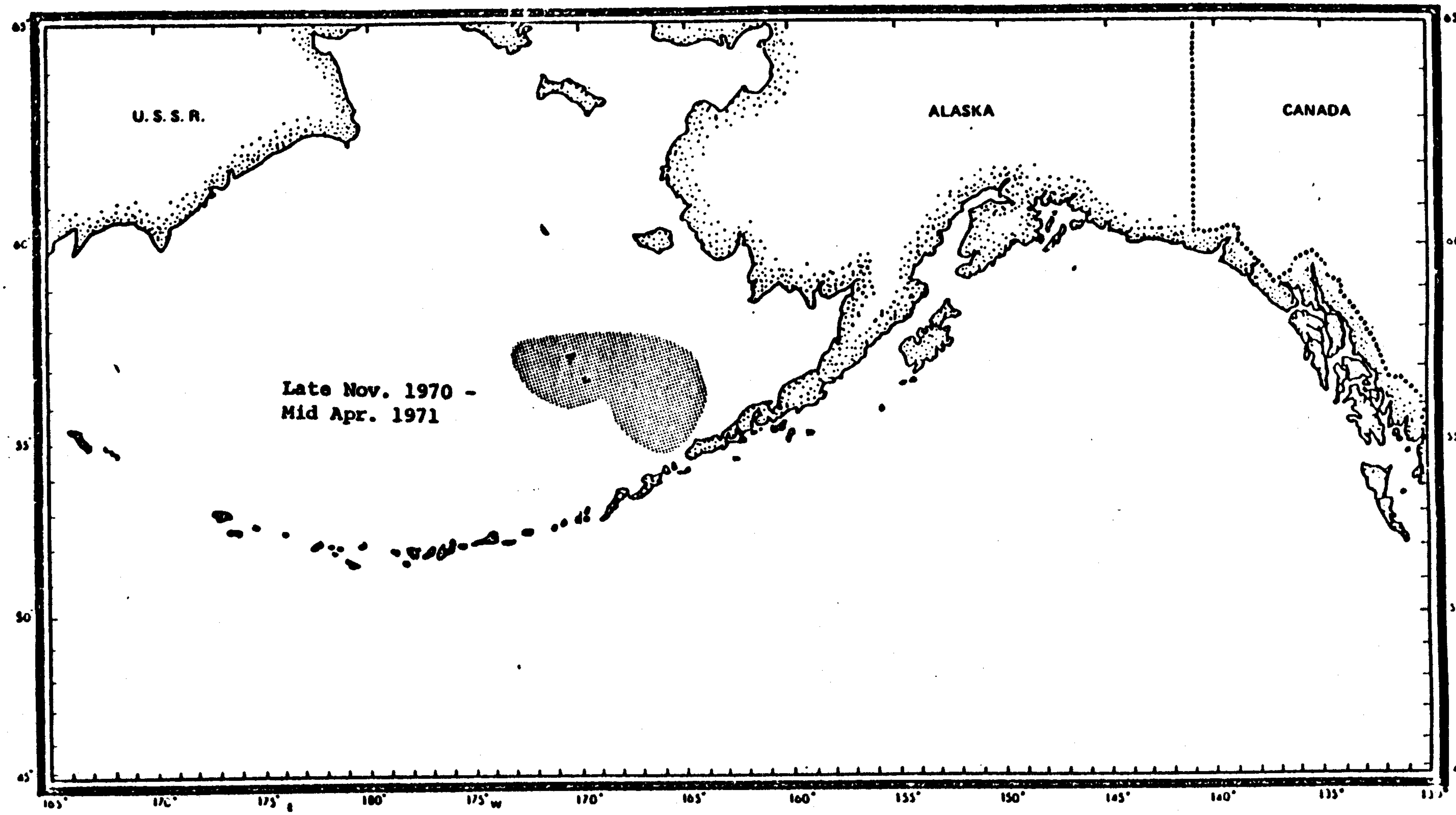

Figure 8.--USSR fishing area for flounders in the eastern Bering Sea in 1971 (Enforcement and Surveillance Division 1973).

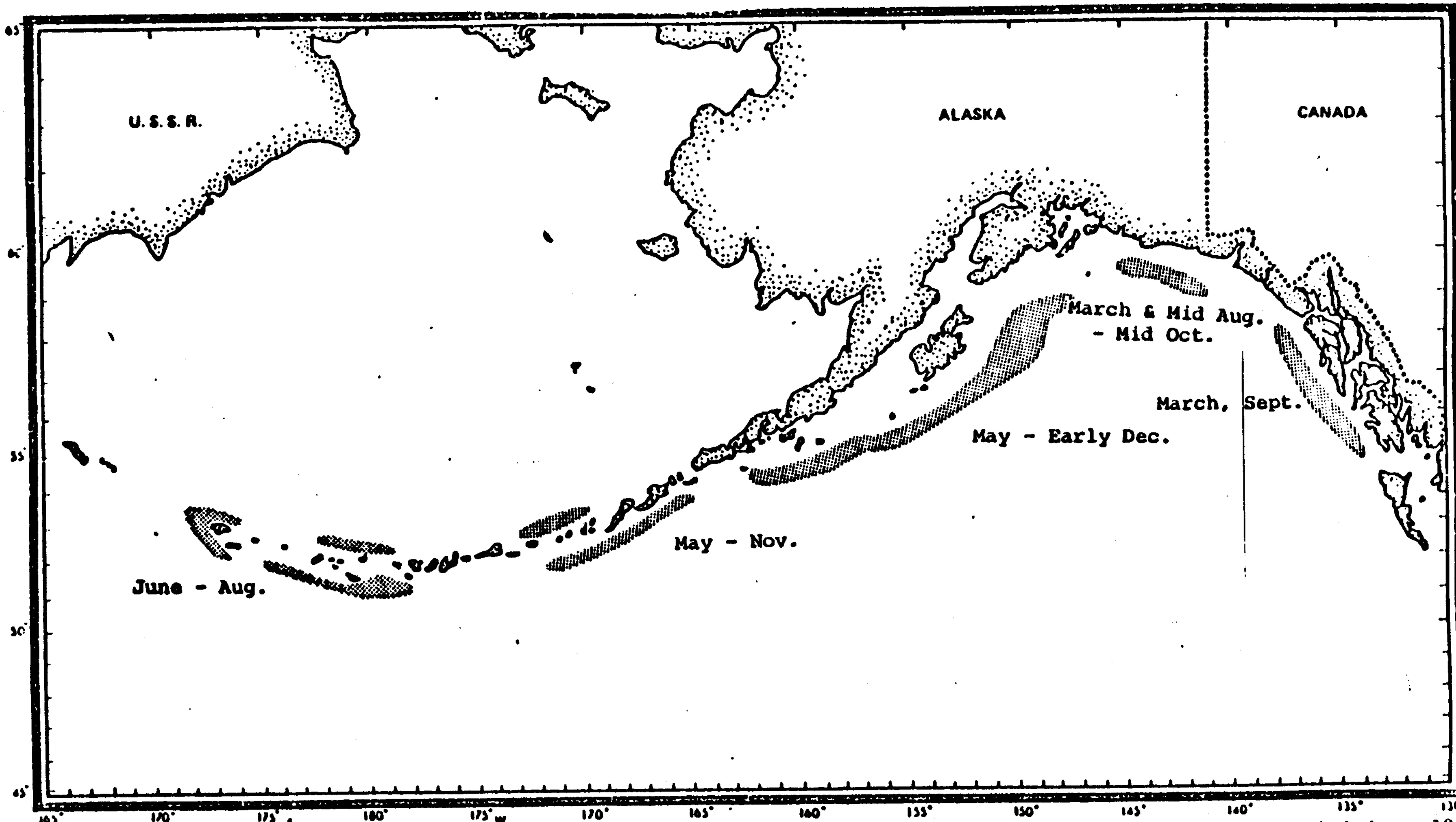

Figure 9 .--Areas fished for Pacific ocean perch by the USSR in 1971 (Enforcement and Surveillance Division, 1973).

compared to 1968. This level of effort generally continued in the next few years with relatively few vessels targeting on Pacific ocean perch, and then for relatively short periods in widely separated areas of the Aleutian Islands. By 1973 and 1974 the fishery was at an extremely low level with catches of only about 3,000 mt in 1973 and 800 mt in 1974. Catches in 1975 and 1976 were somewhat higher, ranging from 7,000-8,000 mt.

Pollock fishery.--The fishery that eventually developed into the pollock fishery began in 1967, but initially targeted on sablefish and large flounders (arrowtooth flounder and Greenland turbot) in the region immediately north of the eastern Aleutian Islands. Fishing was at depths of about 550 to 730 m on the fairly extensive deep-water plateau in the area immediately north of Dutch Harbor in the eastern Aleutian Islands. This fishery was continued in 1968, but the area of fishing was extended north along the edge of the continental shelf to the central Bering Sea. Sablefish and arrowtooth flounder were the principal species taken just north of Dutch Harbor, but farther north, pollock, cod, rockfish, and various flatfish were principal species. In 1969, this fishery became a year-round operation and took on the general appearance that has characterized the fishery to the present time. Vessels utilized in the fishery changed from primarily medium-sized SRTM trawlers to also include the smaller SRT trawlers and large BMRT trawlers. The two larger type trawlers processed their own catches and periodically off-loaded to refrigerated transports for shipment to the USSR. The SRT side trawlers off-loaded their catches to factory ships and other support ships for processing. The fishing area became relatively standardized (Figure 10) with two principal areas used, the first immediately north of the eastern Aleutian Islands and the other northwest of the Pribilof Islands. Effort normally peaked in late winter when fishing vessels from the herring and flounder fishery joined the pollock fleet.

In 1969 and 1970 the fishery targeted on arrowtooth flounder, sablefish, and pollock with incidental catches of cod, rockfish, and other bottomfish. Emphasis of the fishery shifted mainly to pollock in 1971 with catches rising from about 36,000 mt in 1970 to 234,000 mt in 1971. Pollock has remained the predominant species in the catch to the present time. Peak catches of pollock occurred in 1974 when almost 310,000 mt was taken. Catches of other species since 1972 have not exceeded 20,000 mt annually with the exception of rockfish in 1974 at 32,000 mt and rattails at 48,000 in 1972. Large catches of rattails were taken in 1972.

The USSR has continued to trawl along the Aleutians in recent years, but at a relatively low level of effort. Major species in the catches besides rockfish have been pollock and Atka mackerel. Atka mackerel has become a target species of this fishery in winter and spring months.

The monthly range in numbers of vessels employed in the USSR fishery in the eastern Bering Sea and Aleutian Islands is given in Table 7. Peak periods of fishing in the eastern Bering Sea have been in winter, usually in February. In the Aleutian Islands the peak period of fishing has varied, reflecting apparent changes in target species or other factors.

5.2.2.1.3 Korean (ROK) Fishery

Fisheries by the Republic of Korea in the eastern Bering Sea and Aleutian Islands have been much smaller than those of Japan and the USSR (Office of Enforcement and Surveillance 1968, 1969 and 1970; Enforcement and Surveillance Division 1971 and 1973; Law Enforcement Division 1974, 1975 and 1977). Following exploratory fishing in these regions in 1966, an ROK fleet returned to Alaskan waters in September-November 1967 with a commercial operation consisting of a refrigerated transport vessel and eight pair trawlers. The operation was plagued by bad weather and tragedy. Crew members and two of the pair trawlers were lost enroute to the fishing grounds in a storm south

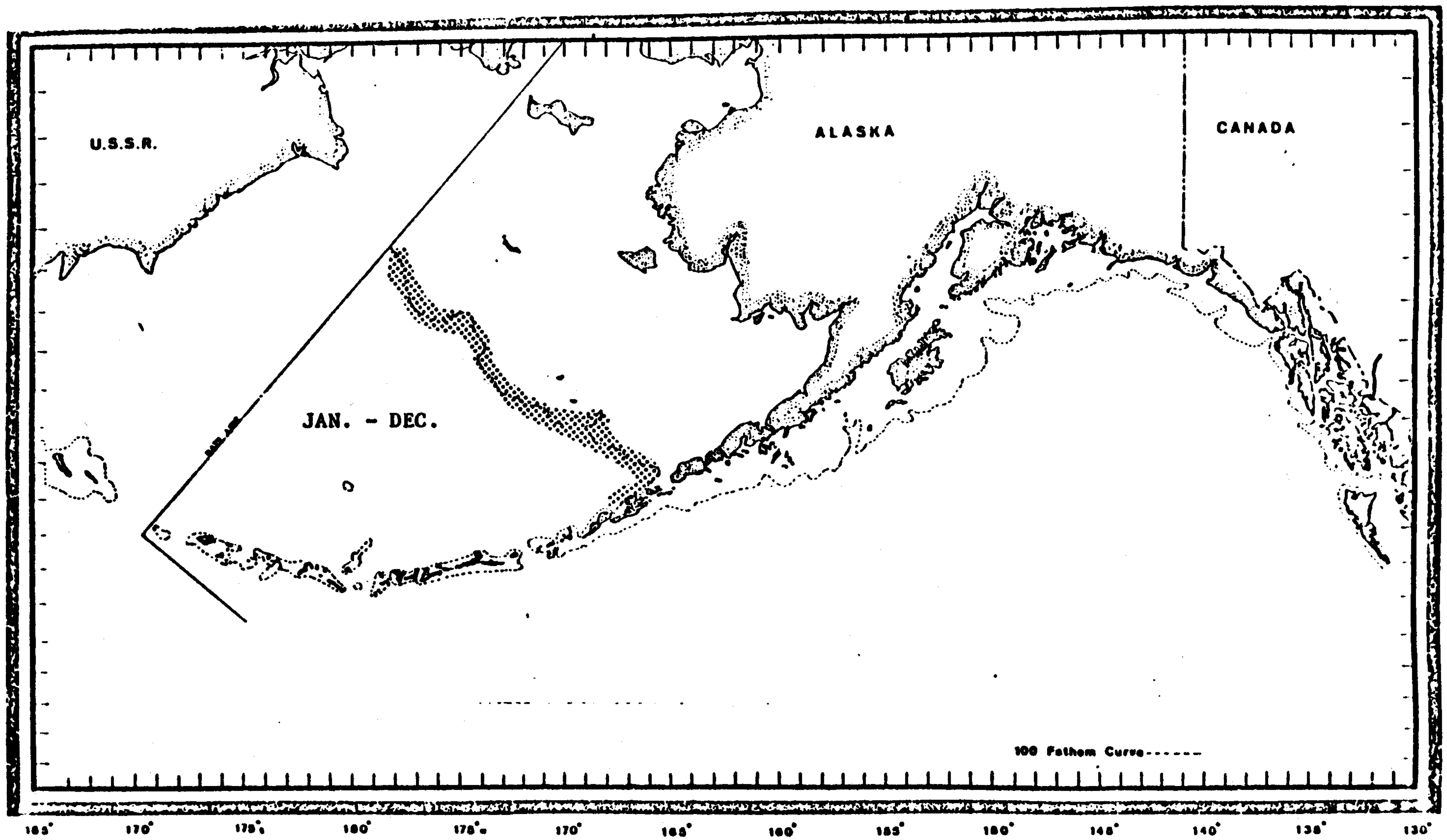

Figure 10.--Fishing areas in the eastern Bering Sea for the USSR fishery targeting mainly on pollock (Law Enforcement Division 1974).

Table 7. Monthly range in number of USSR vessels operating in the eastern Bering Sea and Aleutian Islands in 1966-77 (Office of Environment and Surveillance 1967-70; Enforcement and Surveillance Division 1971 and 1973; Law Enforcement Division 1974, 1975, and 1977).

Year	Range in monthly number					Month of maximum number
	Factory ships[1/]	Factory stern trawlers	Other trawlers	Support[2/]	Total	
Eastern Bering Sea						
1966	0-14	0-15	0-40	0-3	0-72	March
1967	0-15	0-12	0-60	0-3	0-90	Feb. - Mar.
1968	0-13	0-25	2-60	0-2	2-99	February
1969	0-8	0-50	6-67	1-23	7-147	February
1970	0-7	0-52	8-92	0-22	9-173	February
1971	0-8	0-65	5-87	0-21	6-171	February
1972	0-8	0-39	1-89	0-21	3-155	February
1973	0-6	1-27	6-60	0-6	7-82	February
1974	0-5	4-30	6-51	1-10	14-79	Feb. and Apr.
1975	0-4	4-13	5-36	1-7	13-51	June
1976	0-5	2-30	7-48	0-6	13-86	April
Aleutian Islands						
1966	0-3	0-10	0-10	0-1	0-24	August
1967	0-6	0-12	0-21	0-3	0-42	June
1968	0-4	0-14	0-23	0-1	7-28	March
1969	0	0-7	0-13	0-1	3-14	Jan. and Dec.
1970	0	0-5	0-14	0-1	1-15	January
1971	0	0-6	2-15	0-1	6-17	May
1972	0-1	0-5	3-19	0-1	4-21	December
1973	0	0-4	6-17	0-3	6-20	April
1974	0	0-2	0-19	0-5	0-24	March
1975	0-1	0-30	0-10	0-4	2-33	September
1976	0	0-27	0-4	0-5	0-32	May

1/ Including all processing and refrigerated transport vessels.

2/ Including tanker, tugs, cargo, and repair ships.

of the Aleutian Islands. Continued stormy weather permitted only five days of fishing, two of which were south of Unimak Island and the remainder in the Gulf of Alaska.

The ROK expedition was more successful in 1968 conducting operations around the eastern Aleutian Islands and west of the Pribilof Islands from May to July. The fleet, targeting on pollock, consisted of a processor, six pair trawlers, and a refrigerated transport vessel. An independent stern trawler also operated in the eastern Bering Sea in 1968, but the purpose of their fishing activity is not known; it may have been exploratory in nature.

In later years the ROK fishing fleet was enlarged to include factory ships and additional pair trawlers and independent stern trawlers, and eventually longliners and a Danish seiner (Table 8). Based on the number of vessels in the fishery, ROK effort reached its maximum in 1976. The number of vessels shown in Table 8 includes those fishing for herring in the eastern Bering Sea and for other species in the Gulf of Alaska. The principal target species along the edge of the continental shelf in the eastern Bering Sea has continued to be pollock. Some of the trawlers have also fished in the Aleutian Islands for rockfish and pollock. Until 1972, fishing was limited to spring and summer months, but by 1973 the independent stern trawlers had begun to fish in winter months as well. By 1974 the areas of fishing by the trawl fleet had become fairly extensive (Figure 11). Estimates by U.S. surveillance of the ROK fishery indicated that pollock catches ranged between 1,200 and 26,000 mt from 1968 to 1975. The pollock catch reported by the Koreans for 1976 was 85,000 mt in the eastern Bering Sea and 500 mt in the Aleutian Islands area.

An ROK longline fleet, which has mainly fished sablefish in the Gulf of Alaska, began fishing sablefish for brief periods in the Aleutian Islands in 1974. The effort by longliners in Aleutian waters has apparently increased in more recent years.

5.2.2.1.4 Taiwanese (ROC) Fishery

The Taiwanese fishery, which began in December 1974, has involved only one or two independent stern trawlers. The trawlers have fished in winter and spring months along the continental shelf edge west and southwest of the Pribilof Islands. The vessels are believed to have targeted on pollock and flounders.

5.2.2.2 Description of Vessels and Gear

5.2.2.2.1 Japanese Fishery

As outlined in Section 5.2.2.1, the Japanese employ two types of operations in their groundfish fishery, fleet operations involving a factory mothership and catcher boats and vessels that operate independently and process their own catch. Vessels used in each of these fisheries are discussed separately.

Types of mothership fleets and the range in size of motherships as reported by Forrester et al. 1974 are as follows:

Type of fleet	Size of Motherships (gross tons)
Flounder freezing fleets	7,000 - 9,000
General freezing fleets	5,000 - 10,000
Minced fish and fish-meal fleets	9,000 - 27,000
Longline-gillnet fleets	200 - 2,500

Table 8. Number of vessels operating in the Korean groundfish fishery in the eastern Bering Sea, Aleutian Islands, and Gulf of Alaska, 1968-74 (Office of Enforcement and Surveillance 1969, 1970; Enforcement and Surveillance Division 1971, 1973; Law Enforcement Division 1974, 1975, and 1977).

Year	Pair Trawlers	Stern trawlers	Long-liners	Danish seiners	Factory ships	Processors and/or transport vessels	Total
1968	6	1	0	0	0	2	9
1969	7	4	0	0	1	3	15
1970	11	2	0	0	2	2	17
1971	10	3	0	0	1	3	17
1972	0	6	0	0	0	0	6
1973	8	10	1	0	3	0	22
1974	22	5	8	1	2	3	41
1975	0	13	9	1	0	0	23
1976	29	16	12	0	1	0	58

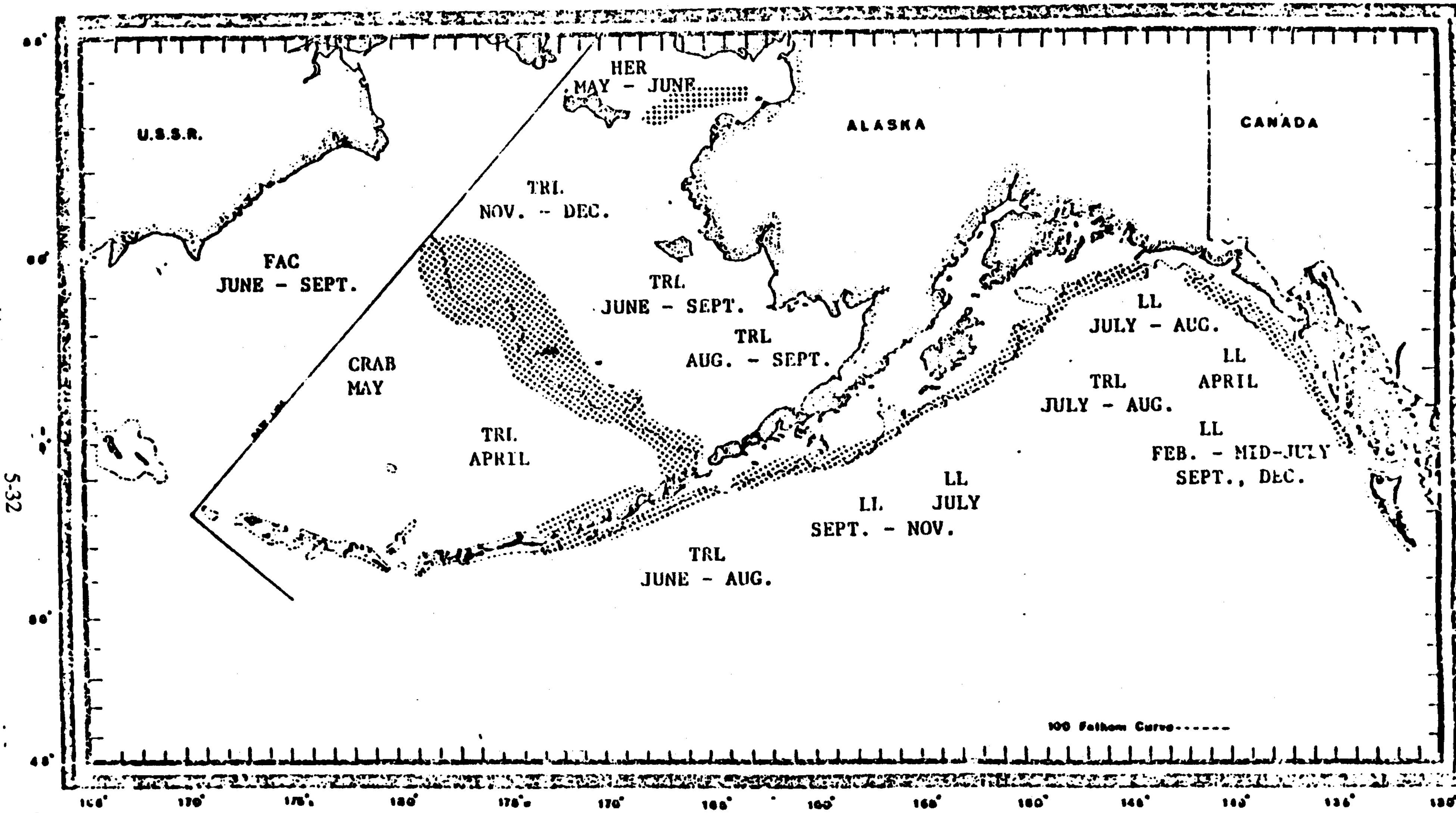

Figure 11.--Fishing areas of the Republic of Korea fisheries in 1974 (Law Enforcement Division 1977).

The motherships are equipped to process catches into such products as frozen fish for human consumption, minced fish (surimi), and meal and oil. Catcher boats supplying the motherships with fish have been of five major types: longline-gillnetters, side trawlers, pair trawlers, Danish seiners, and stern trawlers. Side trawlers have been phased out of the fishery and the number of Danish seiners have declined. Pair trawlers have become the principal vessel type in the freezing and minced fish and fishmeal fleet.

Side trawlers that operated in the fishery were 30 to 52 m long, 150 to 370 gross tons, and had crews of 20 to 30 (Dickinson 1973). The side trawlers usually set and retrieved the trawl from the starboard side, but some were rigged to set from the stern and retrieve to the side. The trawlers usually operated within 55 km of the mothership and used detachable codends so that a number of tows could be made prior to returning to the mothership.

Danish seiners are generally 27 to 46 m in length and 100 to 150 gross tons with crews of 18 to 20 (Dickinson 1973). Danish seiners set the net over the stern and usually retrieve on the port side. The catch is normally brailed aboard, but some newer seiners have stern ramps to haul the catch aboard. Typical gear dimensions of the Danish seiners as determined from a sample of the Japanese fleet are given in Table 9.

Pair trawlers work in two-boat teams, one vessel setting the trawl and the second vessel securing its warp to one wing of the net. When the tow is completed, the net is hauled until one wing can be passed to the other vessel to complete the haul. Detachable cod-ends are used on pair trawlers. Older pair trawlers are 27 to 46 m in length and 100 to 150 gross tons with crews of 15 to 20 (Dickinson 1973). Newer pair trawlers are 37 m in length and 185 gross tons with crews of 14 to 16 men. Typical trawl dimensions used by pair trawlers are observed from sampling the fleet in 1970 and 1975 are shown in Table 9. These data indicate that the average size of vessels and gear increased between 1970 and 1975.

Stern trawlers operating as catcher boats in the mothership fishery are mainly of the 300-350 ton class (Table 9). These smaller stern trawlers average 43 to 50 m in length and carry 20 to 30 men (Dickinson 1973).

Vessels in the Japanese groundfish fishery operating independently of the motherships and processing their own catches consist of stern trawlers and longliners. The independent stern trawlers range in size from about 350 gross tons to over 5,000 gross tons (Table 10). The smaller of these trawlers have operated in the flounder and rockfish fisheries while those targeting on pollock in 1974 and 1976 were larger than 2,000 gross tons. Trawl dimensions were greatest for the larger vessels operating in the pollock fishery (Table 10).

An example of a smaller independent stern trawler is a 500 gross ton vessel averaging 52 to 58 m in length and carrying a crew of 20 to 35 men (Dickinson 1973). The vessels are usually equipped with limited processing equipment, ship freezing units, and refrigerated holds. A medium sized independent stern trawler is 1,500 gross tons, averages 70 to 82 m in length, and carries 70 to 90 men. They normally have a large processing area with modern machinery for washing, heading, gutting and filleting the catch. Plate freezers and refrigerated holds are standard equipment along with reduction plants for producing fish meal. The larger stern trawlers of 2,500 to over 5,000 gross tons range in length from 88 m to over 120 m and carry crews of from 90 to 135. These vessels have equipment for heading, gutting, filleting, and skinning the catch and freezing facilities. Most have reduction plants for producing meal and oil and the larger vessels have equipment for producing minced fish.

Table 9. Range in size of catcher boats in the Japanese mothership fishery and typical trawl gear used based on a sample of the fleets inb 1970 and 1975 (Data for 1969 from Forrester et at., 1974 and for 1975 from Fisheries Agency of Japan 1975).

	Vessels			Typical gear type			
Year	Type	Range in gross tons	Range in horse power	Head rope length (m)	Ground rope length (m)	Cod-end mesh size (cm)	Otter board size (m)
1970	Danish Seine	85 - 300	440 - 850	93	101	7.3	--
1975	Danish Seine	96 - 125	450 - 1350	115	130	9.0	--
1970	Pair trawler	88 - 195	310 - 1200	139	152	9.1	--
1975	Pair trawler	115 - 215	650 - 1400	146	162	9.0	--
1975	Stern trawl	297 - 349	1200 - 2500	48	57	9.0	1.9 x 3.2

Table 10. Range in size of vessels in the North Pacific trawl fishery and typical gear used for principal target species from a sample of the fleet in 1974 and 1976 (Fisheries Agency of Japan 1974 and 1976).

Target Species	Year	Range in vessel size: gross tons	Range in vessel size: horse power	Gear: Head rope length (m)	Gear: Ground rope length (m)	Gear: Cod-end mesh size (cm)	Gear: Otter board size (m)
Pollock	1974	3037-5460	4000-5950	66	65	10	3.2 x 5.0
	1976	2455-5470	3500-5700	66	89	10	2.6 - 4.3
Yellowfin sole	1974	349-499	2100-2500	53	60	9	2.1 - 3.3
	1976	349-3500	1600-4000	57	69	10	2.4 x 3.0
Rockfish	1974	499-3608	1500-4400	50	64	9	2.4 x 3.8
	1976	349-3914	1420-4400	60	73	10	2.2 x 3.3

Independent longline vessels are 36 to 52 m long and 200 to 500 gross tons with crews of 25 to 30 (Dickinson 1973). Their primary target species is sablefish. Some rockfish are taken incidentally. Individual vessels fish about 23 km of longline with approximately 8,000 hooks. The gear is allowed to soak for 12 hours. Frozen squid is used for bait. Typical dimensions of fishing gear is given in Table 11. The vessels are equipped with sharp freezers and refrigerated holds. The longlines remain on the fishing grounds from two to four months until the maximum hold capacities of about 400 mt is reached, after which they return to home ports (Law Enforcement Division 1974).

5.2.2.2.2 Soviet Fishery

Similar to the Japanese groundfish operations, the USSR fishery also employ catcher boats that deliver their catches to factory ships or to processing and freezing transport vessels and vessels that operate independently of factory ships and process their own catches. The USSR has perhaps utilized the flotilla concept of fishing operations to a greater degree than any other nation (Pruter 1976). To allow the fishing vessels to operate at sea for long periods, they are closely supported by numerous other types of vessels including base ships that carry fleet administrators and staff and provide logistic support, factoryships for processing catches, refrigerator transports to replenish stores on the catcher vessels and to receive, freeze, and transport their catches to home ports, and oil tankers, passenger ships, tugs, patrol vessels and occasionally even hospital ships. Refrigerated transports are the mainstays of the support operations. They are of various sizes ranging from 46 to 151 m and from 650 to almost 9,700 gross tons (Law Enforcement Division 1977). Base and factory ships are 110 to 174 m and 5,000 to 18,000 gross tons.

Two basic kinds of fishing vessels have been used by the Soviets, side trawlers and factory stern trawlers (Pruter 1976). Three size classes of side trawlers have been used. Smallest and oldest of the side trawlers is the SRT of 265-335 gross tons, 38 m in length with crews of 22-26 men. The next larger of the side trawlers is the SRTR class of refrigerated medium trawlers of 505-630 gross tons and about 52 m, carrying crews of 26-28. Largest of the refrigerated side trawlers is the SRTM class of about 700 gross tons and 54 m with a crew of about 30. The larger of the side trawlers, particularly the SRTMs, frequently operate independently processing and freezing their own catches, but some may transship their catches to factoryships for processing. A new class of trawler designated as SRTKs have appeared in the fishery in more recent years and are apparently an improvement on the SRTMs. The SRTKs are about 775 gross tons, have stern ramps for more efficient trawling over the stern.

The largest of the Soviet fishing vessels are the factory stern trawlers, the most common of which is the BMRT of 3,170 gross tons, 85 m in length, and carrying a crew of about 90 (Pruter 1976). The factory trawlers usually process and freeze their own catch. A newer class of factory stern trawler, the RTM has come into increasing use in recent years. They are somewhat smaller than the BMRTs, the most common of which is 2,657 gross tons and 82 m long, but has the advantage of a larger deck area aft for handling gear and fish.

Dimensions of typical gear used on Soviet BMRT trawlers fishing for pollock and Atka mackerel are given in Table 12. Data from U.S. observer reports indicate that vertical openings on trawls used for pollock may range from 5-30 m.

Table 11. Range in size of longline vessels and typical fishing gear used in the North Pacific longline-gillnet fishery from a sample of the fleet in 1969, 1972 and 1976 (Fishery Agency of Japan 1969, 1983 and 1976).

	Vessels		Groundline			Gangion			
	Range in gross tons	Range in horsepower	Length of hachi (m)	Gear diameter (mm)	Number hooks per hachi	Length (m)	Diameter (mm)	Size of hook (mm) or size number	Bait
1969	275-499	510-1230	75	9.0	40	1.5	2.0	63 x 14	Frozen squid
1972	300-500	710-1800	75	8.0	35	1.3	---	20	Frozen squid
1976	382-500	540-1110	75	8.0	42	1.3	---	20	Frozen squid

Table 12. Typical trawl dimensions used on Soviet BMRT factory stern trawlers for pollock and Atka mackerel based on data of U.S. Observers in 1976 and 1977.

	Range in vessel size			Typical gear dimensions				
Target Species	Length (m)	gross tons	length Horsepower	Ground- Headrope length (m)	rope mesh size (m)	Cod-end Cod-end mesh size (cm)	liner Otter (cm)	Boards
Pollock	78-87	2657-3837	2000-2320	77.4	77.4	5.0 - 6.0	3	Round to oval variable in size 1600-1800 kgs.
Atka mackerel	78-87	2581-3510	2000	31.0	44.0	5.0	3	Round to oval 1200 kgs.

5.2.2.2.3 Korean and Taiwanese Fisheries

Information on vessels and gear used in the ROK groundfish fisheries is not as well documented as that for the Japanese and the USSR fisheries. Methods of operation are similar to those of the Japanese and Soviets in that they also use factory ship-catcher boat operations as well as stern trawlers, longliners and Danish seiners operating independent of factoryships. The number and size of vessels has increased since the fishery began. Initially, the Koreans used pair trawlers of about 33 m and 133 gross tons and processed the catch aboard vessels ranging in size from 828-957 gross tons (Office of Enforcement and Surveillance 1969). In 1969 they employed a 9,400 gross ton factory ship, 142 m long to process catches of the pair trawl fleet. Independent stern trawlers also entered the fishery in 1969 ranging in size from 131-1,518 gross tons and 35 to 77 m in length (Office of Enforcement and Surveillance 1970).

The subsequent modernization of the Korean fleet is illustrated by information from U.S. Observer reports in 1977 (Table 13). These data indicate that independent stern trawlers in the ROK fleet are comparable in size to the largest trawlers in the Japanese and Soviet fleets with some exceeding 5,000 gross tons. The three vessels observed were targeting on pollock and gear dimensions given in Table 13 may be representative of trawls used by ROK independent trawlers in the pollock fishery.

The Taiwanese have used 1 or 2 independent stern trawlers in their small scale fishery in the eastern Bering Sea. The size of the vessels and dimensions of the gear used are unknown.

5.2.2.3 Catch Trends

Complete catch statistics for groundfish taken by foreign fisheries in the eastern Bering Sea and Aleutian Islands regions have not been available throughout the history of the fishery. Japan has provided the longest and most detailed series of catch data. However, even the Japanese have not always identified some of the flounders to species in their catch data (INPFC 1976). Beginning in 1964, Japan has submitted detailed statistics for their groundfish fisheries to the United States and Canada through INPFC. The identification of catches and reporting of all principal commercial species has probably improved since then. The USSR began to report catch statistics to the United States through bilateral agreement in 1967. Not until 1972 was there a reasonably good breakdown of catches to individual species and even then a detailed area breakdown of their catches was not available. The ROK did not report their catch statistics in detail until 1976. Prior to the reporting of statistics by the USSR and the ROK, their catches have been estimated through U.S. surveillance of the fisheries.

Because of the lack of statistics from some nations and the irregular method of reporting certain species, available catch data for foreign fisheries may not reflect actual exploitation of all species. Statistics for primary target species such as pollock, yellowfin sole, rockfish and sablefish are assumed to be relatively accurate. Since 1970 the catch data for most other commercially important species has probably improved.

Eastern Bering Sea.--Historical trends in total groundfish catches by foreign fisheries in the eastern Bering Sea since 1954 are illustrated in Figure 12; catch statistics by individual species and nation are given in Annex IV. Total catches of groundfish in the eastern Bering Sea have reached two peaks. The first and smaller of these peaks occurred between 1959 and 1963 when Japan and the USSR were targeting on yellowfin sole. Total estimated catches of yellowfin sole and other species reached a maximum of 715,000 mt in 1961. Catches dropped sharply in the succeeding two years, because of a decline in abundance of yellowfin sole, ranging between 300,000 and 400,000 mt during 1963-65.

Table 13. Vessel size and fishing gear dimensions of three ROK independent stern trawlers boarded by U.S. Observers in 1977.

	Vessels				Gear				
Name	Length (m)	Gross tons	Horse-power	Number in crew	Headrope length (m)	Ground-Rope length (m)	Vertical opening (m)	Cod-end mesh size (cm)	Otter Board size (m)
Salvia	84	2285	3200	58	59	78	6	10	2.5 x 3.8
Shin An Ho	106	5680	6000	157	80	75	7	10	3.0 x 5.0
Heung Yang Ho	104	5377	5800	92	74	105	38	10	3.0 x 4.8

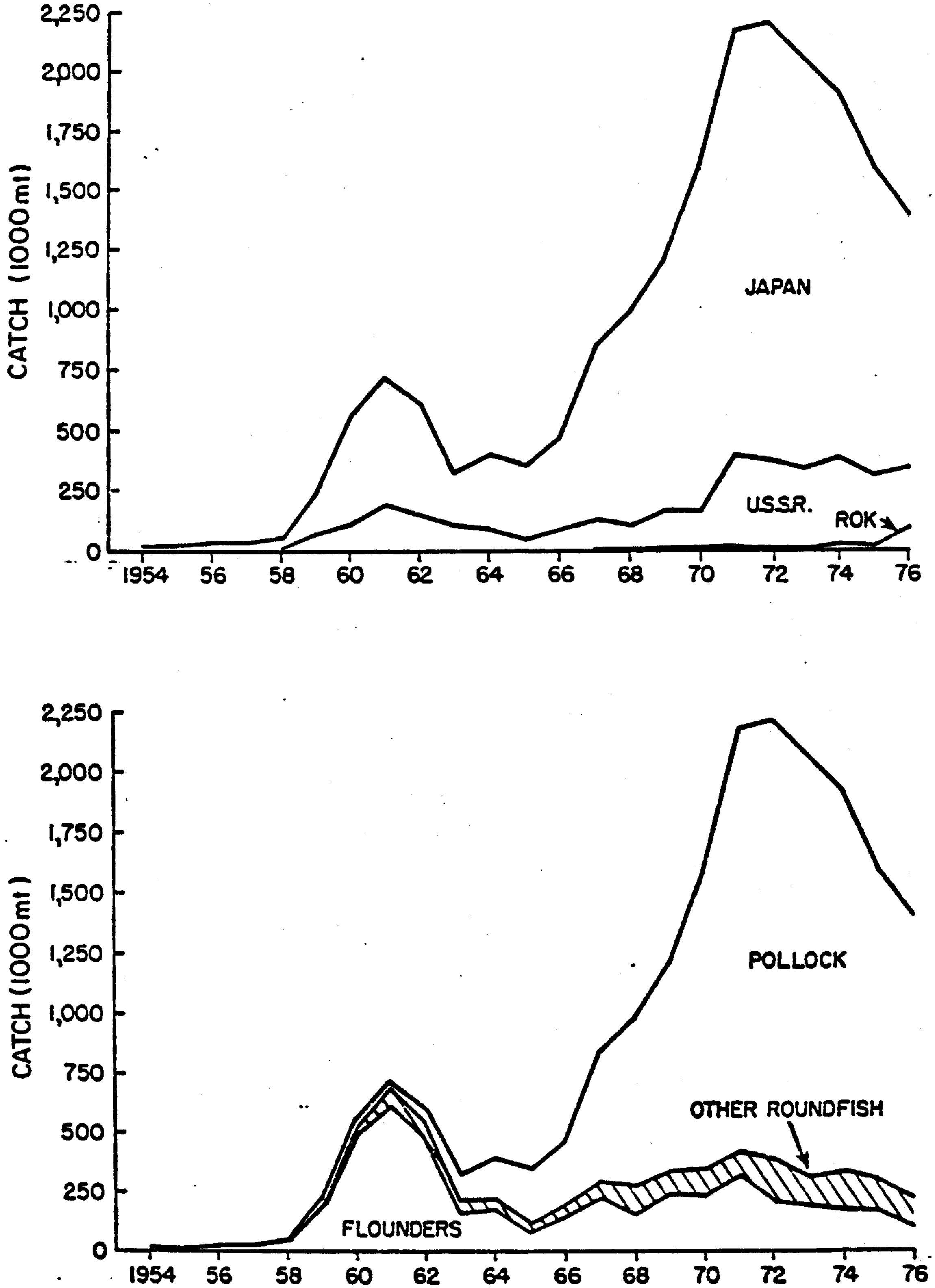

Figure 12.--Foreign catches of groundfish in the eastern Bering Sea (east of 180°) by nation (upper panel) and by species or species group (lower panel), 1954-76.

With the development of the Japanese pollock fishery, total groundfish catches rose rapidly after 1965 and by 1971 exceeded 2 million mt. The total catches of groundfish peaked at 2.2 million mt in 1972 and then declined as catch restrictions were placed on pollock and other species through bilateral agreements between the United States and Japan and the USSR. These catch restrictions stemmed from evidence of deterioration of the various resources. By 1976 total catches had been reduced to less than 1.5 million mt. Throughout the history of foreign exploitation of groundfish in the eastern Bering Sea, Japan has been by far the major user nation (Figure 12). In the early years of the fishery, when yellowfin sole was the major target species, Japan accounted for 68-90% of the total annual groundfish catch in the eastern Bering Sea. This proportion has remained high in later years as pollock became the major target species, ranging from 76-89% annually. Japanese catches peaked at 1.8 million mt in 1972.

Through 1970, the USSR fished primarily for flounders in the eastern Bering Sea and until that year their total catches of groundfish remained less than 200,000 mt (Figure 12). In subsequent years, as their pollock fishery developed, catches of groundfish increased, peaking at 410,000 mt in 1974.

Catches by the ROK have apparently been relatively small. Estimated catches based on U.S. surveillance of their fisheries were no larger than 26,000 mt through 1975 (Annex III). In 1976, however, the ROK reported a total groundfish catch in the eastern Bering Sea of 88,000 mt. Pollock accounted for 85,000 mt of this total.

Flounders (primarily yellowfin sole) were the major species in the eastern Bering Sea catches until 1964, after which pollock predominated (Figure 12). The proportions of pollock in foreign catches generally increased between 1965 and 1970 ranging from 57-79%. From 1971 to 1976 they formed 81-85% of the total groundfish catch. Species of roundfish, other than pollock, have been less abundant than pollock and flounders in catches.

Catch trends of individual species of flounders in the eastern Bering Sea are illustrated in Figure 13. Catches of yellowfin sole reached extremely high levels from 1960 to 1962 with removals of over 1.4 million mt by Japan and the USSR. Catches of this magnitude were more than the stock could sustain and abundance of yellowfin sole declined. Following this deterioration of the resource, catches fell to about 100,000 mt or less, but increased again to reach the 160,000-170,000 mt level in some years between 1967 and 1971. Since 1971, catches have fallen well below 100,000 mt, in part due to the absence of a directed fishery on flounders by the USSR and perhaps to winter area closures in the southeastern Bering Sea which may have reduced catches of yellowfin sole by Japan.

As discussed previously, rock sole, flathead sole, and Alaska plaice have not always been identified in catches, particularly prior to about 1970. Reported catch statistics may therefore inaccurately reflect actual catch trends for these species. Catches of flathead sole apparently peaked in 1971 at 51,000 mt and those for rock sole in 1972 at 61,000 mt (Figure 13). Catches have declined substantially in more recent years which may have resulted to some degree from the reduction in the yellowfin sole fishery where these species are taken incidental to yellowfin sole. There have been no indications of recent substantial reductions in abundance of these species (Bakkala and Wakabayashi 1977).

Catches of Alaska plaice have not shown major fluctuations (Annex III). This species is also taken incidentally in the yellowfin sole fishery and may not always have been identified in catches. The largest reported catch for this species was about 6,900 mt in 1969. Catches since 1969 have ranged from about 300 mt to 3,400 mt.

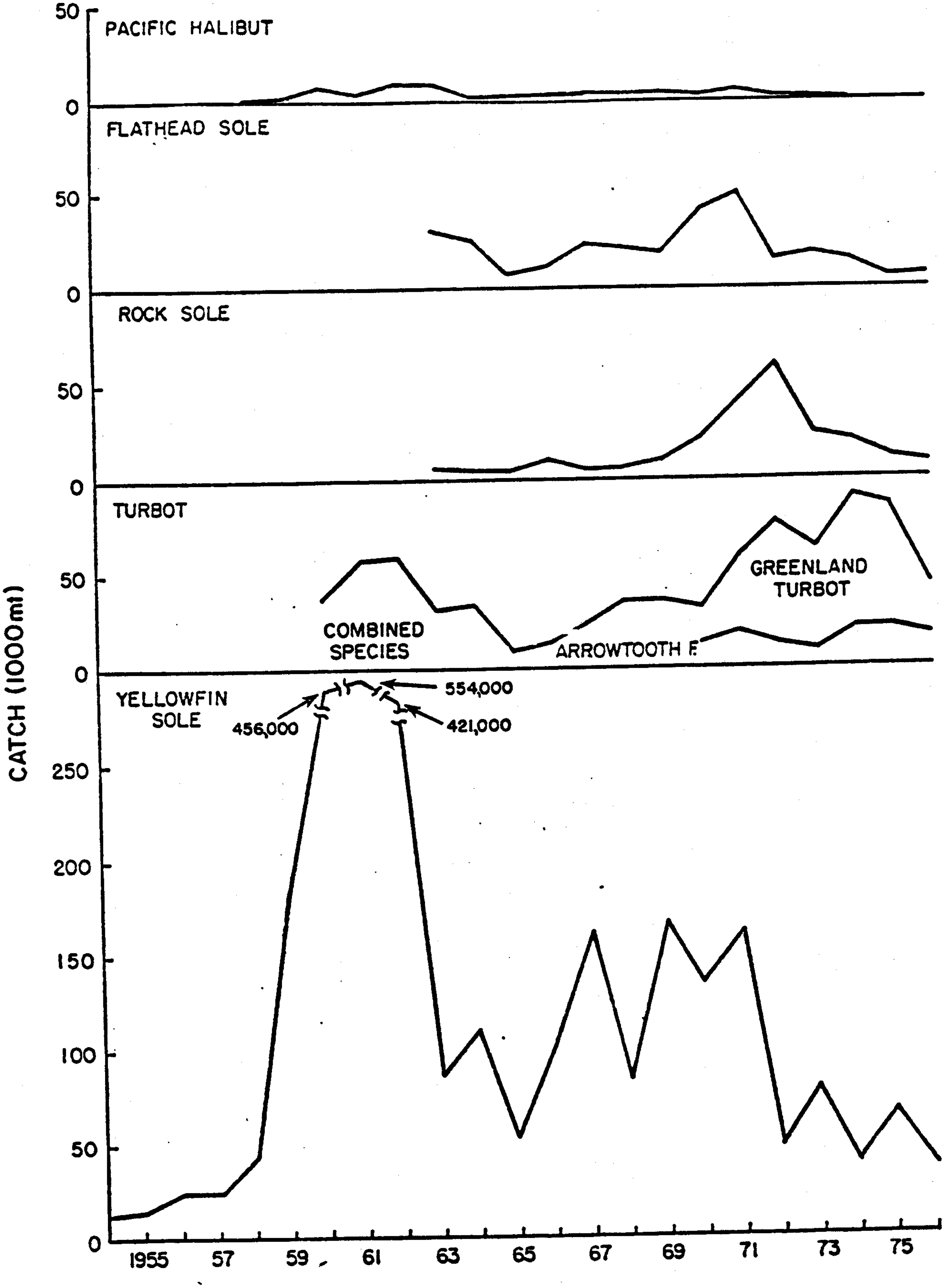

Figure 13.--Catch trends of flounders by foreign fisheries in the eastern Bering Sea, 1954-76.

Catches of turbot (arrowtooth flounder and Greenland turbot) were relatively high in early years of the eastern Bering Sea fishery ranging over 50,000 mt in 1961 and 1962. Japanese fisheries targeted on arrowtooth flounder in this period for the production of fishmeal (Takahashi 1976). Catches dropped below 40,000 mt in 1963-70 as these species were only taken incidentally in the pollock and other directed fisheries. Catches of Greenland turbot increased markedly after 1970 in both the Japanese and the USSR fisheries (Annex III). Total catches of Greenland turbot reached almost 70,000 mt in 1974 and since 1972 have approached or exceeded catches of yellowfin sole.

Reported catches of Pacific halibut in the eastern Bering Sea were relatively small compared to those of other principal flounders. Largest annual catches were made in 1960 (6,900 mt), 1962 (7,900 mt), and 1963 (7,500 mt), and 1971 (4,900 mt). Catches have declined in subsequent years reaching a low of 145 mt in 1976.

Not shown in Annex III are incidental catches of halibut taken by Japanese trawl fisheries targeting on other species. Japan is prohibited from retaining trawl-caught halibut in the eastern Bering Sea, but most released fish die from injuries received during capture. Estimates from observer data indicate that the incidental catch in the eastern Bering Sea increased from about 50 mt in 1954 to over 2,000 mt in 1961; after declining during 1962-63, the catch again increased and peaked at about 3,000 mt in 1971-72 (Hoag and French 1976). Since then, the incidental catch has declined as a result of reduced fishing effort and time/area closures, designed to protect halibut.

Before 1977, Soviet trawlers retained trawl-caught halibut in the Bering Sea. Their catch of halibut, however, was included with other species and not reported separately until 1972. The reported catch since then declined from 490 mt in 1972 to 58 mt in 1976 (Annex III). The reported catch, however, may be too low. Hoag and French (1976) estimated that the Soviet halibut catch averaged about 750 mt during 1959-1970 and then increased sharply to about 2,000 mt during 1971-1974. The catch has probably declined since then due to restrictions on the Soviet fishery.

With the concentration of Japanese fishing effort on pollock starting in 1964, catches of this species rose rapidly to reach 700,000 mt in 1968 (Figure 12). With the entry of the USSR and the ROK into the pollock fishery and greater effort by the Japanese, catches continued to increase reaching a peak of over 1.8 million mt in 1972. With the implementation of catch limitations stemming from evidence of overfishing on pollock, catches declined, falling to about 1.2 million mt in 1976.

Catch trends of demersal roundfish, other than pollock, are illustrated in Figure 14. Peak catches of sablefish and Pacific ocean perch were taken rather early in the fishery. Maximum harvests of sablefish occurred in 1961 and 1962 when 26,000 and 28,500 mt were taken. Catches were relatively stable at a lower level of 9,500-16,000 mt from 1966 to 1972, but declined thereafter falling to 2,700 mt in 1976. Following the peak catch of Pacific ocean perch in 1961 of 47,000 mt, catches dropped to a level of 17,000-29,000 mt from 1962 to 1968 and then declined to 3,600 mt in 1973. A second peak of 39,000 mt was reached in 1974 which was followed by another decline to 16,000 mt in 1976.

Catches of Pacific cod increased steadily in earlier years of the fishery to reach levels of more than 50,000 mt by 1968. Annual catches have been relatively stable since then, ranging around 50,000 mt with the largest catch of 70,000 mt taken in 1970.

The "other groundfish" category represents catches of various species of non- or low commercial value that are taken incidental to target species. Major species groups in this category are probably sculpins, poachers, eelpouts, skates and rattails. Reported catches of this group increased sharply after 1970. A large catch of rattails (48,500 mt) by the USSR mainly accounted for the exceptionally

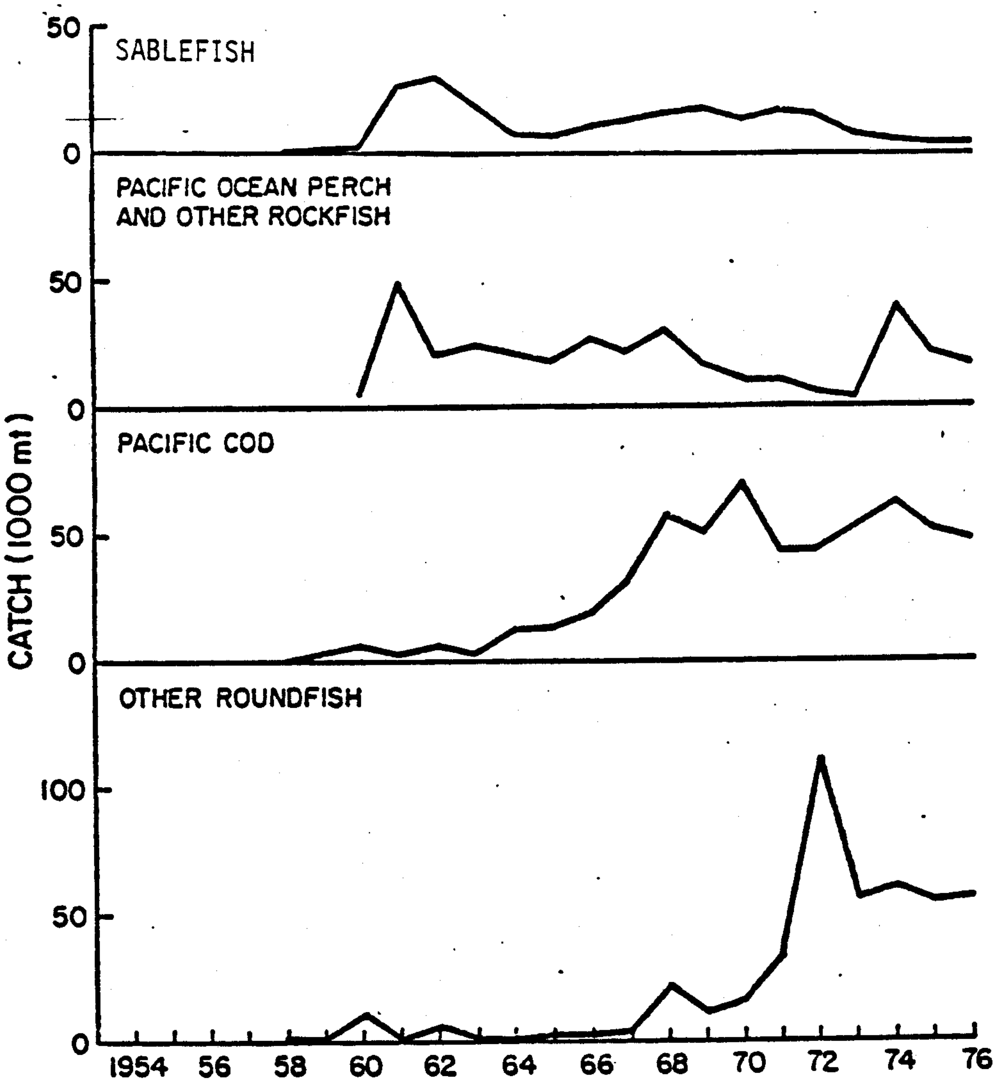

Figure 14.--Catch trends of roundfish (other than pollock) by foreign fisheries in the eastern Bering Sea, 1954-76.

large total catch of "other groundfish" in 1972. The recent general increase in catches of this species category may stem from better reporting rather than an actual increase in catches.

<u>Aleutian Islands</u>.--Characteristics of the foreign fisheries in the Aleutian Islands region differ from those in the eastern Bering Sea in a number of respects. Overall catches have been much lower in the Aleutians, trends in catches and major species in catches have differed in the two regions, and the USSR rather than Japan has taken the greatest share of the catches in the Aleutians (Figure 15, Annex III). Total catches of groundfish reached their peak early in the history of foreign exploitation of the Aleutian Islands resources (Figure 15). Due almost entirely to catches of Pacific ocean perch and other rockfish, catches of all groundfish reached a peak of 114,000 mt in 1965. Since then, total catches have fluctuated at a lower level and shown a general overall decline. In 1975 and 1976, catches were in the range of 55,000-60,000 mt. The USSR has taken the largest share of the catches in the Aleutians with the exception of some recent years. Rockfish (mainly Pacific ocean perch) has been the primary target species in the Aleutians of both Japan and the USSR. Catches of demersal roundfish have increased markedly since 1973, perhaps due in part to better reporting of these species, but also because the USSR has had a target fishery on Atka mackerel in this period. Catches of Atka mackerel reached 20,000 mt in 1976. Catches of "other roundfish" have exceeded those of rockfish since 1973 because of the decline in abundance of Pacific ocean perch (Low et al. 1977) and the increase in catches of Atka mackerel and better reporting or actual increases in catches of such species as pollock and Pacific cod.

Flounders have formed a relatively small proportion of the total catches in the Aleutians. The small flounders (yellowfin sole, rock sole, flathead sole, and Alaska plaice) occupy this region in low abundance based on catch statistics (Annex III). The main species of flounders taken have been Greenland turbot and arrowtooth flounder.

Catches of Pacific ocean perch and other rockfish reached their peak in 1965 at 109,000 mt (Figure 15). Since then they have shown an almost continual decline with minor increases in 1970, 1972, and 1974. Catches fell again following 1974 to range from about 17,000-18,000 mt in 1975 and 1976.

Catch trends for individual species of roundfish, other than rockfish, are illustrated in Figure 16. Catches of Pacific cod have been small, showing some increases in recent years with a peak catch of 3,800 mt in 1976. This increase may simply reflect better identification and reporting of cod in the fisheries. Catches of sablefish have remained relatively stable at a low level throughout the period of foreign fishing in the Aleutians. The largest catch of 3,600 mt was taken in 1972. Sablefish have been a target species of longline fisheries by Japan and the ROK in Aleutian Island waters.

The USSR began to report significant catches of Atka mackerel in 1972. From 1974 to 1976 catches rose rapidly as the Soviets concentrated effort on this species, reaching 20,000 mt in 1976 and exceeding catches of any other groundfish species in the Aleutians in that year. Reported catches of pollock have also increased in recent years reaching a peak of 23,000 mt in 1974. Almost all of the catch in 1973-76 was taken by USSR fisheries. It is unknown whether the Soviets directed some effort to pollock in the Aleutians region in these years or whether they were an incidental part of catches in other fisheries.

Catches of "other groundfish" have shown fluctuations from year to year, but no definite trend. This category probably consists mainly of non-commercial species or species of low commercial value such as sculpins and rattails. Fluctuations in this catch category may result partially from methods of recording and reporting these species. In 1972, when the largest catch of "other groundfish" occurred,

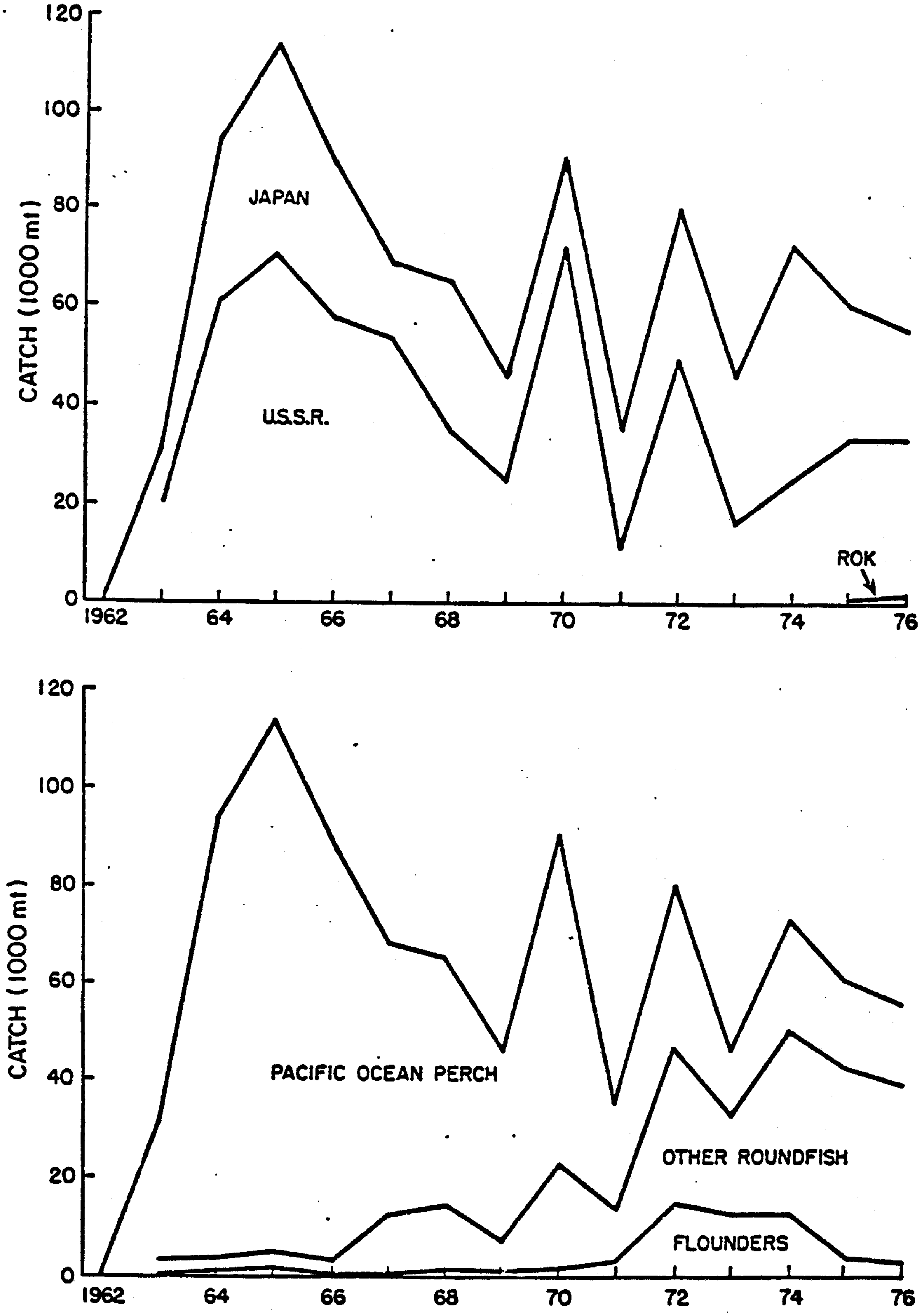

Figure 15.--Foreign catches of groundfish in the Aleutian Island area (170°W - 170°E) by nation (upper panel) and by species or species group (lower panel), 1962-76.

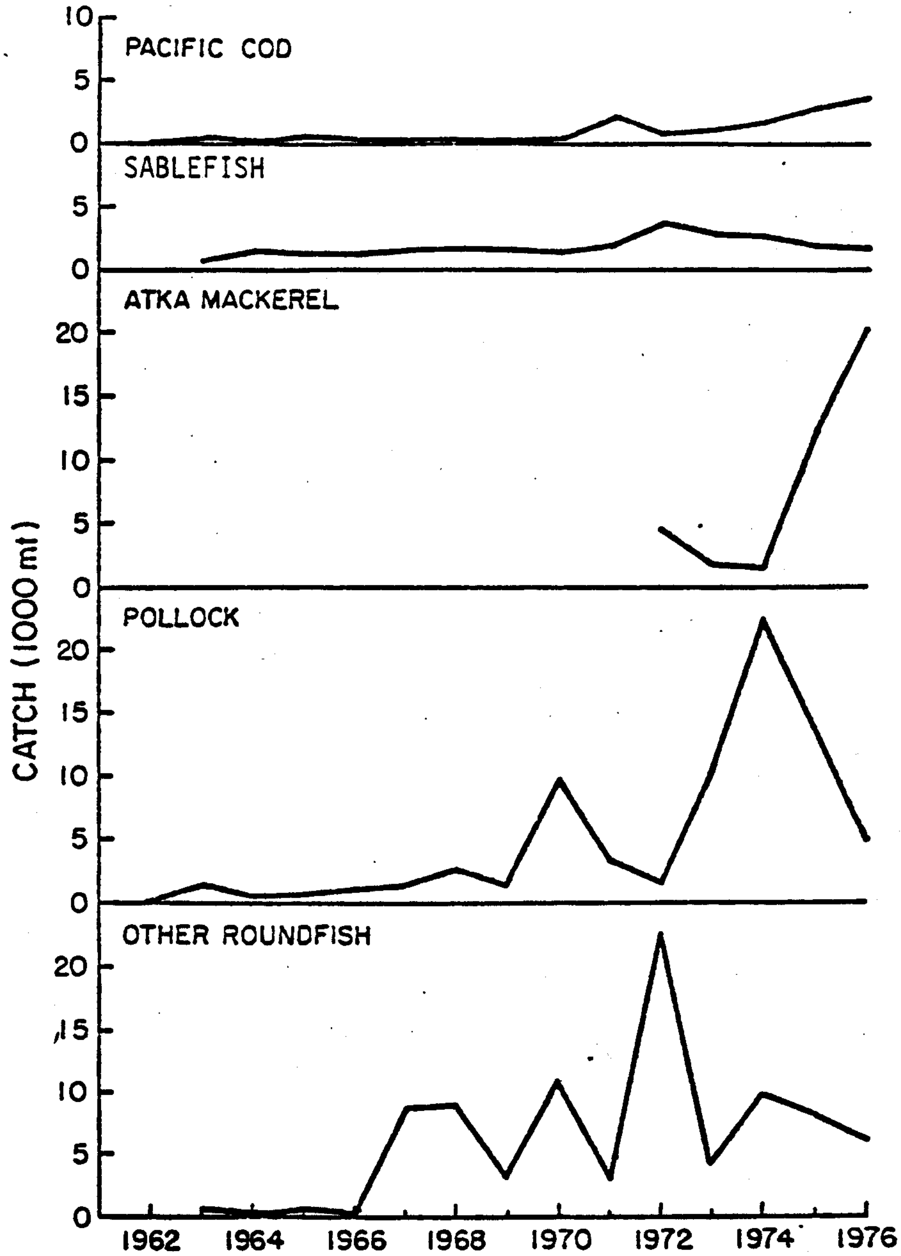

Figure 16.--Foreign catches of commercially-important species of roundfish (other than Pacific ocean perch) in the Aleutian Island area, 1962-76.

the USSR reported 5,300 mt of rattails and 9,700 mt of sculpins. In later years the Soviets did not identify these species in their catch statistics and their total annual catches of "other roundfish" ranged from only about 200-1,600 mt. The reported Japanese catches of "other groundfish" increased from 1968 reaching 8,000 mt in 1974 and 1975.

Flounders have in most years formed only a minor part of the total groundfish catch in the Aleutian Islands area (Figure 17). Reported annual catches of small flounders have usually been less than 100 mt. After reaching a peak of almost 1,300 mt in 1975, annual catches of Pacific halibut have ranged from about 400 mt to less than 150 mt. Reported catches of arrowtooth flounder and Greenland turbot were also low until 1970, after which they increased sharply, with Greenland turbot the primary species taken. Catches in 1972-75 ranged from about 12,000 to 14,000 mt. Japanese fisheries were responsible for this rise in catches of turbot (Annex III).

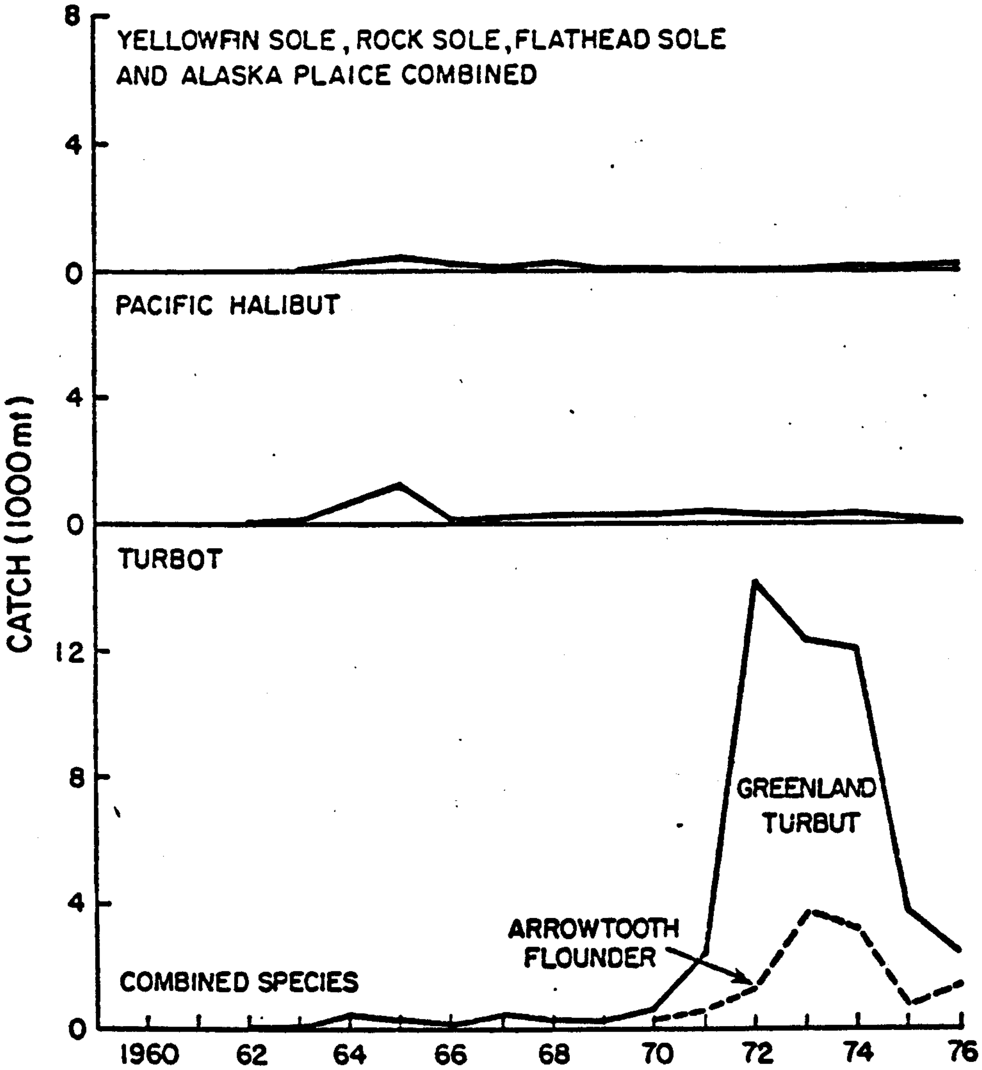

Figure 17.--Catch trends of flounders by foreign fisheries in the Aleutian Island area, 1962-76.

6.0 HISTORY OF MANAGEMENT

6.1 Domestic

6.1.1 Measures Employed to Regulate Fishery

Fishery restrictions on U.S. Nationals have been established by the U.S. Bureau of Commercial Fisheries (the predecessor of the National Marine Fisheries Service), the State of Alaska and the International Pacific Halibut Commission. The BCF was responsible for both research and management of domestic fisheries in Alaska before statehood in 1958. The BCF imposed restrictions on the size, character, and operation of trawls to be used to capture groundfish (Table 14). In 1959 the State of Alaska assumed responsibility for regulating the groundfish fisheries of Alaska. A history of the state's groundfish regulations is included in Table 14. Many of the regulations were specific to the Gulf of Alaska where domestic fisheries have been more active.

In addition to regulations given in Table 14, the State of Alaska requires all commercial fishermen landing any species of fish or shellfish in Alaska to possess a commercial fishing license, and the captain or owner of all fishing vessels are required to license their vessels and the fishing gear employed. Buyers are required to keep records of each purchase and show the number and name of the vessel, the State license number of the vessel, date of landing, pounds purchased of each species, statistical area in which the fish was caught, and the kind of gear used in taking the fish.

The chronology of different regulatory measures for the Pacific halibut fishery as well as their rationale are discussed by Dunlop et al. (1964), Bell (1967) and Skud (1977). Before 1963, the North American halibut fishery in the Bering Sea was managed by the International Pacific Halibut Commission (IPHC). From 1963 to 1977, IPHC recommended regulations, but these had to be approved by the International North Pacific Fisheries Commission (INPFC). Since the onset of regulations in 1932, several changes have occurred in the boundaries defining regulatory areas in the Bering Sea and Aleutians. Some of the changes were in response to tagging studies that indicated a relationship between halibut stocks in the Aleutians and the Gulf of Alaska. However, most of the changes were designed to obtain a desired distribution of fishing effort and to facilitate enforcement.

Except for a period in the late 1940s and early 1950s and again in 1963-64, quotas have not been used to manage Bering Sea halibut stocks. Instead, restrictions have been based on the length of the season. Until the late 1950s, the Bering Sea season coincided with that of IPHC Area 3 (the Gulf of Alaska west of Cape Spencer), but by the early 1960s, the opening of the Bering Sea often was a month earlier than in Area 3. The earlier opening was established to encourage fishermen to exploit Bering Sea stocks. Since 1965, the fishing time has been limited to three weeks or less in the spring and fall or both. This curtailment was necessary because of the drastic decline in abundance of halibut.

Other regulations include licensing requirements, gear restrictions, minimum size limits, and closed areas. IPHC requires that all setline vessels over 5 net tons be licensed; there is no fee and annual renewal is not required. Licensed vessels must maintain a log book showing the daily catch, effort, and the fishing area. From 1932 to 1973, vessels also were required to "clear" for fishing a particular area and submit a "statistical return" at the completion of each trip. These requirements have since been deleted.

In 1938, the regulations prohibited the use of set nets for catching halibut. Nets of any kind were prohibited in 1944, and this restriction has continued to the present day. The definition of nets was expanded to include pots in 1972. IPHC's justification of trawl prohibition was based on evidence that halibut caught by trawls usually are below the optimum harvesting size.

The size limit of halibut was introduced into the regulations in 1940. The minimum size that that time was 5 pounds, head-off, dressed. The purpose of the size limit was to reduce the catch of halibut that were below the optimum harvest size, but there also was an economic reason. The industry favored the regulation because small halibut were often of poorer shipping quality and of lower value. In 1973, the minimum size limit was increased and expressed in terms of length: 32 inches from the tip of the lower jaw to the end of the middle of the tail. The increase was justified based on an increase in growth rate.

In 1967, IPHC Area 4E in southeastern Bering Sea was declared a nursery area and a year-round closure was instituted that still is in effect.

6.1.2 Purposes of Regulatory Measures

The limited number of groundfish regulations implemented by the State of Alaska were primarily designed for the protection of species of high commercial value such a salmon, herring, juvenile halibut, and shellfish. Examples of such regulations were the restrictuions on use of pot gear, gillnets, otter trawls, and seines (Table 14).

With regard to halibut, IPHC is restricted by the present convention to manage for MSY and cannot consider other goals or economic factors. Regulations in the Bering Sea and Aleutians were designed to accomplish this goal. Specifically, season and quota restrictions controlled fishing mortality; minimum size limits, gear restrictions, and closed areas reduced the mortality on suboptimum sized halibut; the timing of the seaons and the area designations affected the distribution of fishing effort and facilitated enforcement; licensing, and statistical requirements provided scientific information on stock condition.

6.2 Foreign

6.2.1 Measures Employed to Regulate the Fishery

A number of regulatory measures affecting groundfish fisheries have been implemented through public laws and international agreements prior to enactment of the U.S. Fishery Conservation and Management Act of 1976. Initial regulatory measures originated from the International Convention for the High Seas Fisheries of the North Pacific Ocean involving Canada, Japan, and the United States, which was brought into force in 1953. The Convention provided for establishment of the International North Pacific Fisheries Commission (INPFC) to provide and coordinate scientific studies necessary to ascertain and recommend conservation measures required to ensure maximum sustained productivity of fishery resources in the Convention area (Forrester et al. 1974). One of the provisions of the Convention prohibited Japan from fishing halibut in certain areas and, starting in 1958 Japan agreed to abstain from fishing halibut providing that stocks of halibut continued to meet qualifications for abstention, e.g., that the stocks were under substantial exploitation by two or more of the contracting parties.

In 1962 member nations of INPFC agreed that halibut east of 175°W. in the Bering Sea no longer continued to qualify for abstention (Forrester et al. 1974). Following the removal of halibut from the abstention list, joint conservation measures were implemented by member nations of INPFC in 1963 which included a catch quota of 5,000 mt in a triangular area east of 170°W. Following a catch of 5,000 mt in the quota area in 1963, catches dropped abruptly and Japan withdrew her longline fleetfrom the quota area after 1964. Although agreement between INPFC member nations was never reached to return halibut to the abstention list, Japan has not chosen to conduct a target fishery on halibut east of 175°W. since 1964.

Table 14. Historical summary of Alaska groundfish regulations.

Year	Legal gear, definitions, and other regulations
	Earlier records not available
1940	Use of trawls prohibited except for shrimp, flounders when not capturing, injuring or destroying other food fish, and spider and King crab west of 150°W longitude exclusive of Cook Inlet.
1942	Trawls prohibited in fishing for salmon, herring, and Dungeness crab.
1948	Gear restrictions: Trawls. The size, character, and operations of otter trawls in Alaskan waters are limited as follows: (a) Otter trawls having mesh smaller than 5 inches stretched measure between knots in the bag and 6 inches stretched measure between knots in the wings are prohibited: Provided, that otter trawls now in use having mesh smaller than that specified may be used through the calendar year 1949 if registered with the Regional Director, Fish and Wildlife Service, Juneau, Alaska. (b) The use of any devices attached to the footrope or elsewhere, such as chain "ticklers", which may cause undue disturbance or destruction of the bottom, is prohibited. (c) The use of otter trawls in any area which the International Fisheries Commission has found to be populated by small immature halibut and accordingly has closed to all halibut fishing, is prohibited. (d) All operators of otter trawls shall maintain a running log on forms furnished showing date, type and size of mesh of trawl used, each locality fished, the time and duration of each tow and the estimated poundage and number of average weight of each species caught. Such logs shall be available for inspection by representatives of the Fish & Wildlife Service at any reasonable time, and the duplicate sheets shall be transmitted to the Fish and Wildlife Service at periodic intervals. On or before December 15 of each year complete statistics of operations shall be submitted to the Fish and Wildlife Service on forms provided for the purpose. (e) The use of any trawls in commercial fishing for salmon, herring, and Dungeness crabs is prohibited.

Table 14. Historical summary of Alaska groundfish regulations. (Cont'd)

Year	Legal gear, definitions, and other regulations
1949	The following species besides salmon were defined as commercial fish: Albacore (Germo alalunga) tuna Cod (Gadus macrocephalus) codfish, true cod, grey cod Eulachon (Thaleichthys pacificus) smelt, hooligan Halibut (Hippoglossus stenolepis) Herring (Clupea pallasii) Lingcod (Ophiodon elongatus) Rockfish (all species of genus Sebastodes also known as rockcod and sea bass) Sablefish (Anoplopoma fimbria) black cod Sheefish (Stenodus mackenzii) inconnu Sole and flounder (all species of family Pleuronectidae)
1958	Trawl fishermen no longer required to fill out log books.
1959	Alaska Statehood Trawls illegal for taking crab.
1960	Longlines and trawls maybe used to take groundfish. Longlines are the only legal gear with which to take sablefish within S.E. Alaska. Halibut are to be regulated according to IPHC regulations 5AAC 39.390.
1961	All defined legal gear became legal for the taking of groundfish excepting S.E. sablefish.
1967	S.E. sablefish: a 2 1/2, #20 thread or less gillnet may be aboard vessel for taking bait.
1968	S.E.: sablefish taken incidentally by longline or otter trawl maybe retained in an amount not to exceed ten percent, by weight, of each landing.
1970	Pots became legal sablefish gear within S.E.
1972	Incidental allowable catch of sablefish increased to 20%. 1962 regulations (5AAC 39.390) referring to IPHC management of halibut repealed.

Table 14. Historical summary of Alaska groundfish regulations. (Cont'd)

Year	Legal gear, definitions, and other regulations
1976	An untreated cotton escape for sablefish pots required within S.E. Also under General Provisions, Groundfish Fishery, Gear for Groundfish. (a) Groundfish may be taken by trawls, hand troll gear, seines, longlines and pots except as legal gear may be further restricted by groundfish gear regulations of chs. 03-39 of this title and except as follows. (1) king and Tanner crab pots as defined in chs. 34 and 35 of this title may not be used to take groundfish in the areas where the regulations defined those pots: (2) groundfish taken by power gurdy troll gear being fished for salmon consistent with applicable state laws and regulations are legally taken and possessed. (3) All commercial longline or skate gear buoys or kegs shall be marked with permanent department registration number of the vessel fishing this gear.
1977	Crab pots are not defined for all areas. The most restrictive definitions are as follows: A king crab pot is a pot with rigid tunnel eye openings and which individually are a <u>minimum</u> of five inches in one dimension, and tunnel eye opening perimeters which individually are larger than 30 inches. A Tanner crab pot is a pot with rigid tunnel eye openings which individually are a <u>maximum</u> of five inches in one dimension, and tunnel eye opening perimeters which individually are larger than 30 inches; or a pot which tapers form its base to a top consisting of one horizontal opening of undescribed size. Same as 1976 except that sunken or diving gillnets maybe used for groundfish upon issuance of a permit by the commissioner (ADF&G).

U.S. Public Law 88-308, enacted in May 1964, made it unlawful for foreign vessels to fish within the 3-mile territorial waters of the United States or to fish for designated fishery resources of the adjacent U.S. Continental Shelf. In October 1966, U.S. Public Law 89-658 established a 9-mile contiguous fishery zone adjacent to the U.S. 3-mile territorial sea. The law provided that the United State would have the same jurisdiction over fisheries within this newly created zone as it had within its 3-mile territorial waters subject to the continuation of traditional fisheries by foreign nations.

In 1964, the U.S. initiated bilateral agreements with Japan and the USSR to allow continuation of their traditional fisheries within the contiguous zone in certain areas of Alaska (Office of Enforcement and Surveillance 1968). One provision of the 1964 agreements was the establishment of a king crab pot sanctuary adjacent to the north side of Unimak Island and the western Alaska Peninsula that prohibited trawling year-round. The purpose of the sanctuary was to prevent gear conflicts between mobile foreign gear and domestic fixed gear. An adjacent area, closed to trawling during winter, in order to reduce incidental catches of juvenile halibut, was added in later bilateral agreements.

The agreements with Japan and the USSR were renegotiated at two-year intervals. Subsequent agreements created some changes in areas of fishing withing the U.S. contiguous zone, and provided areas within the zone for transshipment of cargo between foreign fishing and support vessels. This series of agreements was expanded to include Canada in 1970, allowing for reciprocal fishing privileges within the contiguous fishing zone. Agreements were also signed with the ROK in November 1972, and with Poland in May 1975. No fishery agreements have been signed with Taiwan.

Starting in 1973, the bilateral agreements between the United States and Japan and the USSR begin to include catch quotas for these nations in the eastern Bering Sea and Aleutian Island regions. Annual quotas for the years 1973-76 are given in Table 15.

In addition to the crab pot sanctuary, the bilateral agreements have provided other area-time closures to Japanese and Soviet trawl fisheries for the protection of halibut. These closures are designed to reduce the incidental catch of halibut by trawl fisheries in areas and time periods that halibut form concentrations. Area-time closures currently in effect for these fisheries are shown in Figures 18a and 18b.

Restrictions on Polish and ROK fishing vessels in the eastern Bering Sea and Aleutian Islands region are shown in Figures 19 and 20.

Current regulations pertaining to foreign groundfish fisheries are found in Section V-A of the Preliminary Fishery Management Plan for the Trawl Fishery of the Bering Sea and Aleutian Islands, and include catch limitations, prohibition on the retention of certain species of importance to the United States, and time-area closures to prevent gear conflicts and provide protection to halibut. Catch limitations imposed on foreign fisheries in 1977 are listed in Table 16.

6.2.2 Purposes of Regulatory Measures

Most of the regulatory measures pertaining to foreign groundfish fisheries in the eastern Bering Sea and Aleutian Islands were implemented for conservation of halibut stocks and to prevent gear conflicts between foreign trawlers and domestic fixed gear (crab pots and halibut setlines). In negotiating these restrictions on foreign fisheries in international waters, certain concessions were provided the fisheries involved in terms of fishing and loading privileges within the U.S. contiguous fishing zone.

Table 15. Catch quotas applicable to Japanese and Soviet fisheries in the eastern Bering Sea and Aleutian Island region in 1973-76.(MT)

Area/fishery	Species	1973	1974	1975-76
		Japan		
Eastern Bering Sea Mothership-North Pacific Trawl	Pollock	1,500,000	1,300,000	1,100,000
	Groundfish other than pollock	--	--	160,000
	Herring	1/ (33,000)	1/ (33,000)	15,000
North Pacific Longline-Gillnet	Herring	2/ (4,600)	2/ (4,600)	3,000
Landbased Dragnet	Groundfish (All species)	--	--	35,000
Aleutian Region Mothership-North Pacific Trawl and Longline-Gillnet	Pacific ocean perch	--	--	9,600
	Sablefish	--	--	1,200
Landbased Dragnet	Groundfish (All species)	--	--	8,500
		U.S.S.R.		
Eastern Bering Sea	Flatfish	100,000		3/
	Pollock	--		210,000
	Herring	--		30,000
	Other Species	--		120,000
Aleutian Region	Rockfish	--		12,000
	Other species	--		16,000

1/ 1969 level
2/ 1971 level
3/ Included in other species

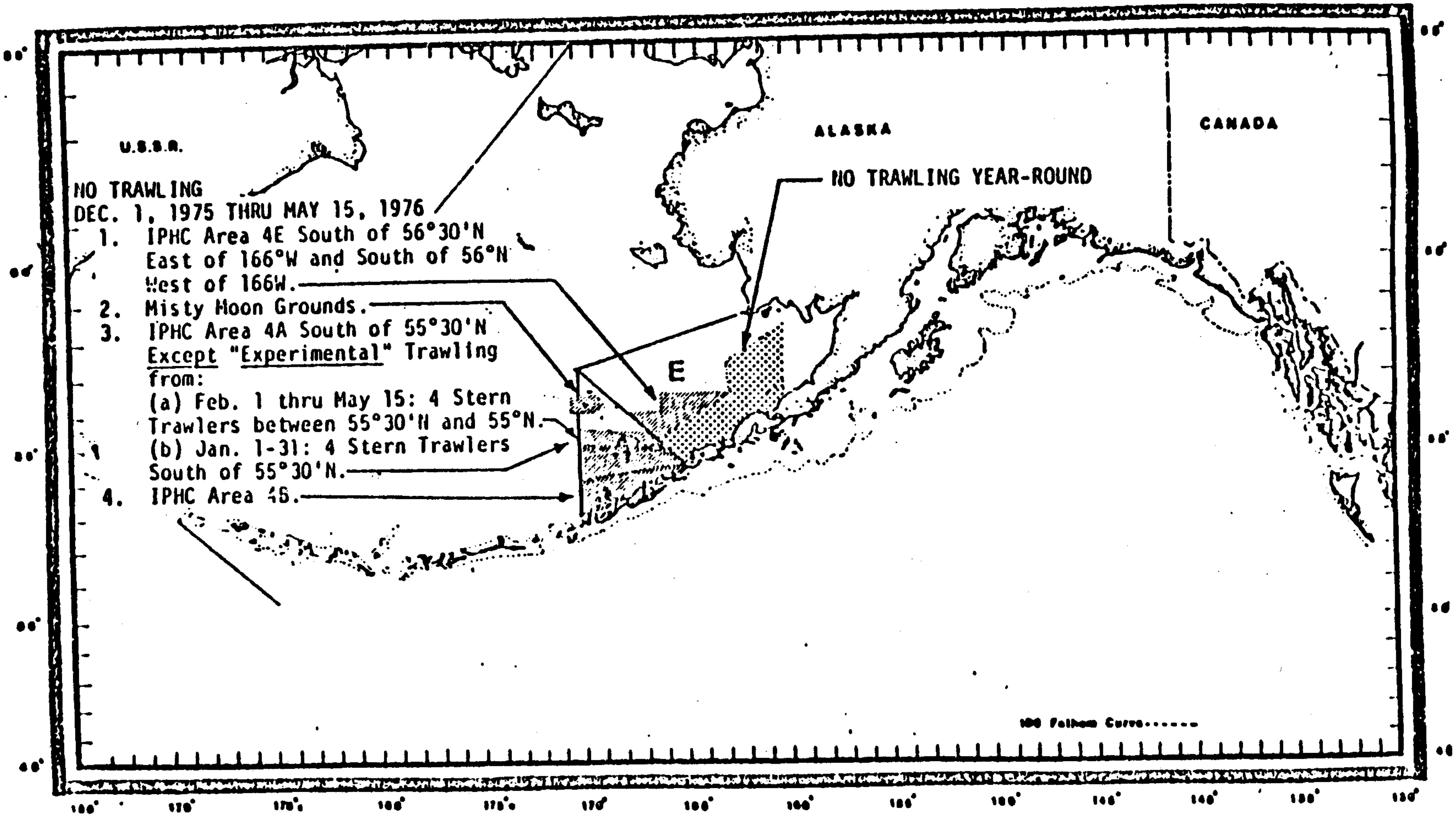

Figure 18a--Area-time closures and restrictions for Japanese trawl fisheries in southeastern Bering Sea, effective through December 31, 1976.

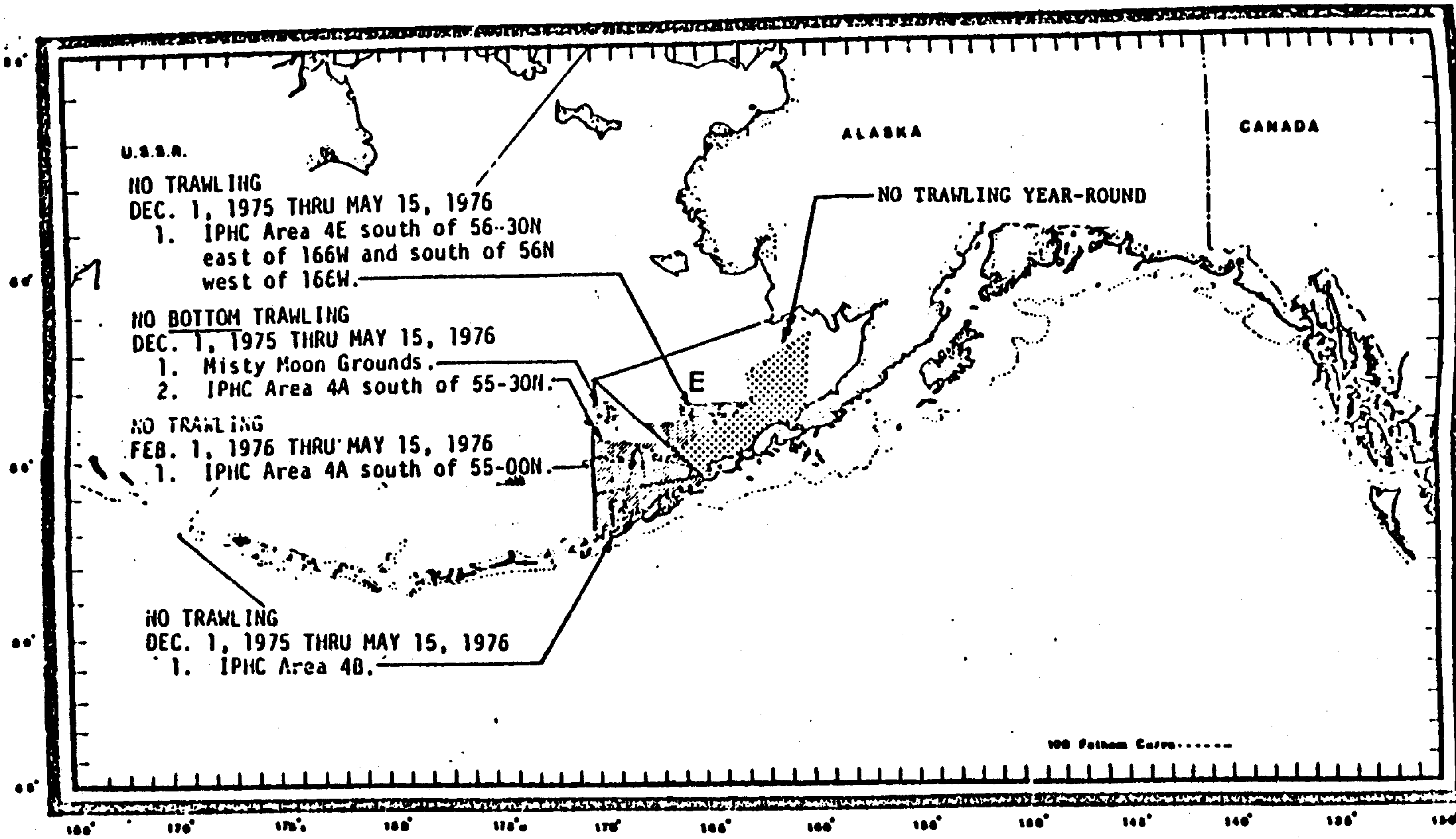

Figure 18b--Area-time closures and restrictions for Soviet trawl fisheries in southeastern Bering Sea, effective through December 31, 1976.

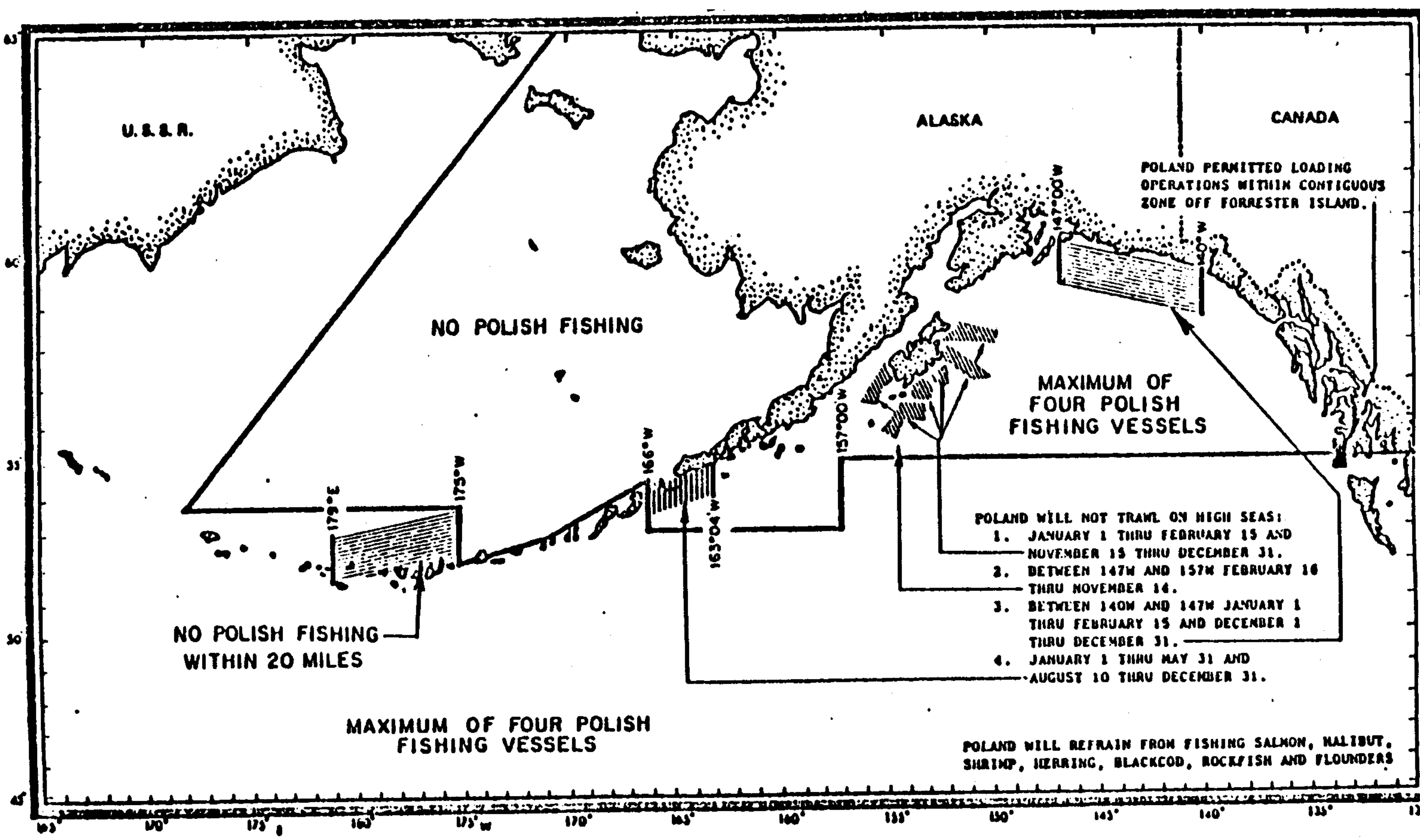

Figure 19.--Area-time closures and restrictions for fisheries of the Polish People's Republic in the Gulf of Alaska and Bering Sea, effective through December 31, 1976.

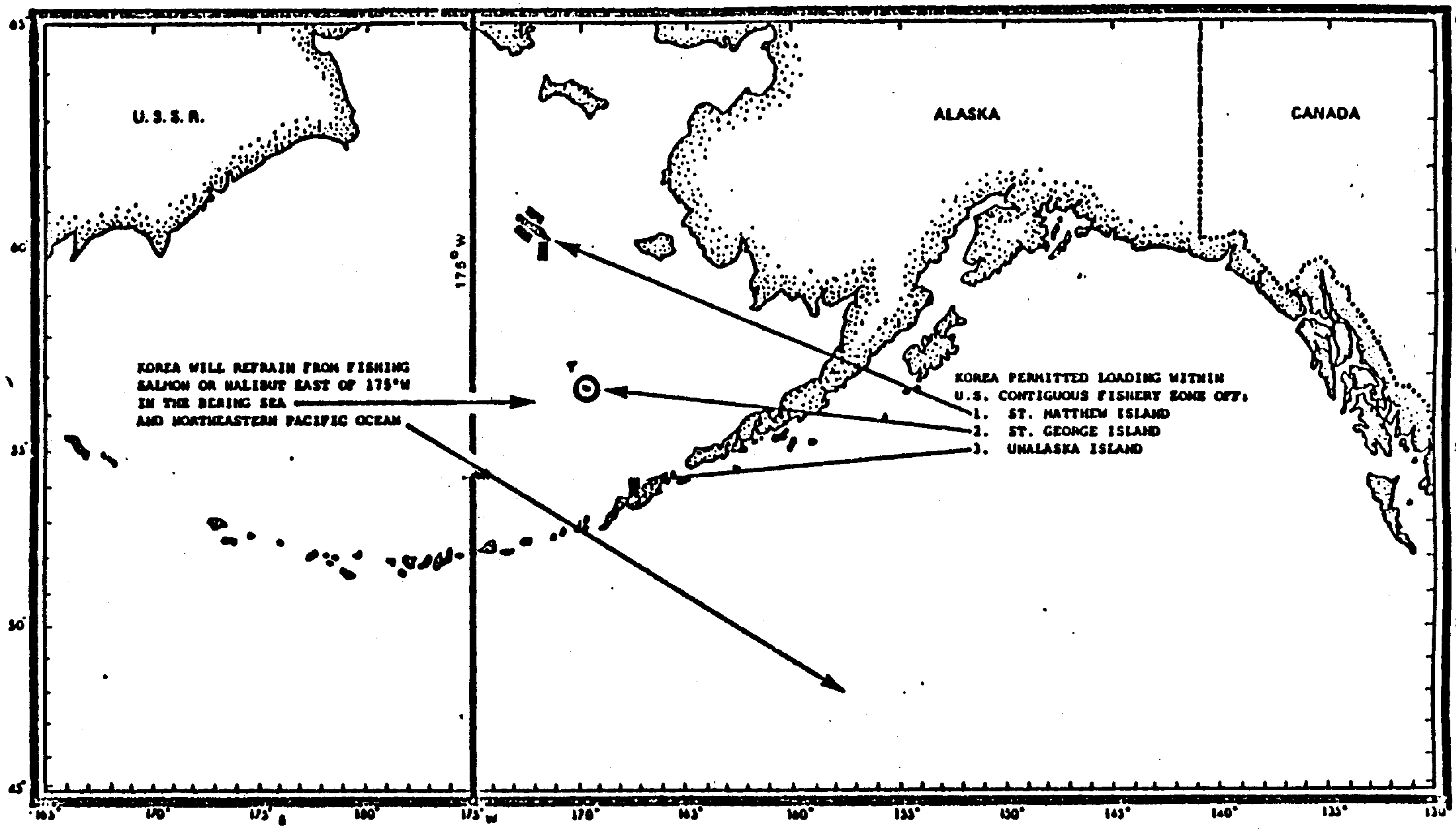

Figure 20.--Provisions of the United States-Republic of Korea Fisheries Agreement effective through December 12, 1977.

Table 16. 1977 Groundfish and squid catch limitations (1000 mt) for foreign fisheries in the eastern Bering Sea and Aleutian Islands region.

Species	Area	Japan	USSR	Nation ROK	Taiwan	Total assigned	Unassigned1/	Total Foreign allocation
Pollock	Bering Sea/ Aleutians	792.3	112.7	40.0	5.0	950.0	0	950.0
Sablefish	Bering Sea	3.6 2/	0.6 3/	0.4 2/	0.2 3/	4.8	0.2	5.0
	Aleutians	2.0 2/	0.2 3/	0.2 2/	0	2.4	0	2.4
Pacific cod	Bering Sea/ Aleutians	38.1	17.2	0	0	55.3	2.7	58.0
Yellowfin sole	Bering Sea/ Aleutians	62.1	40.8	0	0	102.9	3.1	106.0
Other flounders	Bering Sea/ Aleutians	61.5	40.4	0	0	101.9	3.1	105.0
Pacific ocean perch	Bering Sea	2.8	3.5	0	0	6.3	0.2	6.5
	Aleutians	6.5	8.1	0	0	14.6	0.4	15.0
Other groundfish	Bering Sea	40.4	17.4	1.6	0.2	59.6	0	59.6
	Aleutians	23.1	9.9	0.89	0.11	34.0	0	34.0
Squid	Bering Sea/ Aleutians	10.0	0	0	0	10.0	0	10.0

1/ Portion of total foreign allocation unassigned for possible use by a domestic fishery.

2/ Includes incidental trawl catch.

3/ Incidental catch only.

With the decline in abundance of halibut in the eastern Bering Sea in the mid-1960's, negotiations were directed toward reducing or preventing foreign fisheries from targeting on halibut. When it became apparent that these measures were not creating the desired improvement in the condition of the halibut stock, other measures involving time-area closures were negotiated to reduce the incidental catch of halibut by foreign trawl fleets. The retention of trawl-caught halibut was also prohibited.

As evidence became available of deterioration in the condition of other bottomfish stocks in the eastern Bering Sea and Aleutian Islands, negotiations were initiated to limit or reduce foreign catches of these species in an attempt to arrest these declines and restore the resources to higher productivity. Catch quotas for Japanese and Soviet fisheries were first implemented in 1973 and were carried forward, with some modifications, until 1977 when foreign fisheries came under jurisdiction of the U.S. Fishery Conservation and Management Act.

6.3 <u>Effectiveness of Management Measures (foreign and domestic)</u>

Closures to foreign trawling of crab and halibut fishing areas have undoubtedly reduced conflicts between the foreign trawlers and U.S. fixed gear. Gear losses have continued, but recent losses have occurred outside areas closed to foreign trawling.

Restrictions on the North American setline fishery have reduced fishing mortality on stocks of adult halibut, but the primary problem appears to be a reduction in the number of young halibut entering the fishery. Recent time-area closures have reduced the incidental catch by foreign trawlers and the abundance of young has increased since 1972 (Table 17). Although the increase is encouraging, it will not improve conditions in the setline fishery for several years, and abundance is still well below that in the 1960s. The present poor condition of the resource probably is a result of several factors: excessive setline removals in the early 1960s, high incidental catches of juvenile halibut by foreign trawlers in the 1960s and early 1970s, and reduced productivity from adverse environmental conditions (Hoag, 1976). Because halibut are a long-lived species, rehabilitation of the resource will be a lengthy process regardless of present management measures.

Regulations in the form of catch quotas implemented in 1973 and later years to mitigate the deterioration in condition of other groundfish species in the eastern Bering Sea and Aleutians have perhaps begun to show some benefit for certain species while not for others. Other factors such as year-class strength, time-area closures designed to protect halibut but also beneficial to other species, and the reduction of effort on some species, may have also influenced the current status of some stocks.

Catch limitations have reduced the catch of pollock from over 1.8 million mt in 1972 to 950,000 mt in 1977. Based on analysis of catch and effort data from the commercial fishery the abundance of pollock declined through 1975 (Low et al. 1977). Preliminary evidence that abundance in 1976 was similar to that in 1975 (INPFC 1977) offers some indication of an arrest in the decline of pollock abundance in the eastern Bering Sea. Lower fishing mortality, stemming from the catch limitations, have probably helped to lessen the decline in the pollock stock and may be contributing to a halt in this decline.

For species such as Pacific ocean perch and sablefish there has been, as yet, no evidence that catch restrictions have improved the poor condition of these stocks. In the case of long-lived and slow growing species like Pacific ocean perch and sablefish several years will be required before evidence is available to judge the effectiveness of current management policies.

Table 17. Relative abundance of juvenile halibut by age group from the Bering Sea Index Stations, 1966-1977 (from IPHC 1977b).

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Total
			Numbers per hour trawled				
1966	0.2	17.2	4.9	7.6	0.9	0.2	31.0
1967	0.6	4.3	4.6	6.0	0.5	0.6	16.6
1968	0.3	6.4	1.8	3.1	0.5	0.4	12.5
1969	2.7	4.1	4.7	0.4	0.7	0.2	12.8
1970	0.4	8.8	2.0	0.7	0.2	-	12.1
1971	3.7	2.6	7.6	0.3	-	-	14.2
1972	0.1	2.0	0.5	0.4	0.1	-	3.1
1973	0.1	3.7	1.9	0.7	0.2	-	6.6
1974	0.1	1.2	3.7	0.8	0.3	-	6.1
1975	0.5	3.2	5.3	2.0	0.7	0.1	11.8
1976	0.3	6.5	4.5	1.2	0.3	0.1	12.9
1977	0.4	5.4	9.5	2.1	1.4	0.1	18.9

There is evidence that the condition of stocks of yellowfin sole, rock sole, flathead sole and Alaska plaice have improved or remained relatively stable in recent years (Wakabayashi and Bakkala 1977; Bakkala and Wakabayashi 1977). Their condition has benefited from a series of relatively strong year-classes originating in the late 1960s. Winter time-area closures in the southeastern Bering Sea, designed for the protection of halibut, also benefit these species because they form winter concentrations in this area as well. The absence of a directed Soviet fishery on these species of flounders since 1972 may have additionally benefited the stocks. Thus, factors other than management measures directly applicable to the four small flounder species may be responsible for their current status. Catch limitations, however, are designed to maintain and improve their productivity.

For other principal species considered in the plan (Pacific cod, Atka mackerel, arrowtooth flounder, Greenland turbot, and squid) information is lacking to adequately assess the current condition of the stocks relative to the recent past. There is no evidence to suggest that the stocks are depressed and catch limitations are designed to maintain the population at current levels.

7.0 HISTORY OF RESEARCH

Investigations of groundfish resources of the eastern Bering Sea have been conducted by the United States, Canada, Japan, and USSR. U.S. research efforts have been of the longest duration (1880 to present) and were initiated to assist the development of U.S. cod and halibut fisheries. As these and other fishery resources of the eastern Bering Sea became increasingly utilized, and in some cases overfished in the decades of the 1960s and 1970s, investigations became more directed towards providing guidelines for resource management and conservation.

7.1 United States 1/

The first major study of the demersal fishery resources of any consequence occurred in 1890 when the U.S. Fish Commission's steamer Albatross was directed into the southeastern Bering Sea to determine the locations and characteristics of important cod-fishing grounds (Rathbun 1894). Later, in 1911, the Albatross also investigated halibut banks just north of Unimak Island (Alexander 1913). In 1930 the International Pacific Halibut Commission (IPHC) conducted exploratory setline fishing along the Aleutian Islands and tagging of halibut in Makushin Bay on the north side of Unalaska Island (Dunlop et al. 1964).

The first extensive and systematic survey of demersal fishery resources of the eastern Bering Sea was conducted in 1941 by the U.S. Fish and Wildlife Service (Fishery Market News 1942). Bottom trawling was conducted in the southeastern Bering Sea north to St. Lawrence Island, and in Norton Sound. Although the primary purpose of the survey was to locate areas of king crab abundance, information was also collected on the quantities and types of demersal fish encountered.

Continued interest in the commercial potential of crab and groundfish of the eastern Bering Sea resulted in further investigations after World War II. There were cooperative U.S. government-industry ventures in the northeastern Bering Sea in 1947 (King 1949) and in 1948 (Wigutoff and Carlson 1950). The IPHC resumed exploratory setline fishing and tagging of halibut in the eastern Bering Sea in the 1950s (Dunlop et al. 1964).

With the development and intensification of fisheries in the eastern Bering Sea in the 1950s and 1960s, U.S. and IPHC research surveys began to be conducted in a more systematic and standardized manner. These investigations initially sought improved information on changes in abundance and recruitment of king crab and halibut, but other species were also later included. The U.S. Bureau of Commercial Fisheries (now the National Marine Fisheries Service) began systematic annual bottom trawl surveys in the southeastern Bering Sea in 1955 to obtain information on the distribution, abundance, biology, and recruitment of king crab. These surveys were interrupted for the period 1962-1965, but were continued in 1966. In 1968, Tanner crab was included in these surveys and received special study, and in 1971 biological studies of important groundfish species were also added. These annual crab-groundfish surveys are a continuing activity by the NMFS. In the late summer of 1975 and spring of 1976, NMFS conducted multivessel groundfish and shellfish surveys in the eastern Bering Sea to provide baseline environmental information to the Bureau of Land Management's Outer Continental Shelf Environmental Assessment Program.

1/ Includes Canadian research done in cooperation with the U.S., within the framework of the International Pacific Halibut Commission.

Beginning in 1963 and annually since 1965, the IPHC has been systematically monitoring by means of bottom trawl surveys the distribution and abundance of young halibut in the eastern Bering Sea (Best 1969a and b; 1970; 1974).

In recent years, U.S. observers have been placed aboard foreign fishing and processing vessels to examine catches of target species (primarily pollock), and incidentally-caught halibut.

7.2 Foreign

Japanese research investigations in the eastern Bering Sea began in the mid-1950s, although there had been some experimental trawl fishing on bottomfish by Japanese commercial interests in this region in the early 1930s (Kibesake 1965). In 1956 the Oshoro Maru engaged in limited exploratory trawl fishing in the eastern Bering Sea. The Oshoro Maru has continued investigations from the 1950s to present time (Hokkaido University 1957, 1960, 1964-66). Other limited trawling investigations were conducted in 1961 through 1964 (Shimonoseki University of Fisheries 1966; Tsuruta et al. 1962).

Extensive and systematic surveys of eastern Bering Sea groundfish by the Japanese were begun in 1963 by the Japan Fishery Agency (JFA), and have continued annually with the exception of 1972 (Japan Fishery Agency 1975 b). These surveys have covered broad areas of the continental shelf, and in some years the shelf edge and upper continental slope. Included in the Japanese investigations have been tagging studies on halibut, sablefish, pollock, and yellowfin sole.

The Japanese have been collecting catch and effort statistics and biological information from their groundfish fisheries since 1964, and providing these data to the U.S. through the International North Pacific Fisheries Commission.

Although the Soviet Union conducted limited exploratory surveys in the eastern Bering Sea in the early 1930s and early 1950s (Moiseev 1963), their first extensive investigations of demersal fish and shellfish resources in the eastern Bering Sea were during 1957-63. The main purpose of these surveys was the determination of the extent and potential uses of resources prior to commercial exploitation by the Soviet fleet. Information was also gathered on the biology of important species populations and environmental features associated with their distributions (Moiseev 1963-64; 1970).

Since 1963, the Soviet Union has continued its research on eastern Bering Sea fishery resources, which have included pollock and other demersal fishes.

8.0 SOCIOECONOMIC CHARACTERISTICS OF THE DOMESTIC FISHERY

8.1 Commercial Fishery

8.1.1 Commercial Fishing Fleet

In 1977 less than 100,000 pounds of groundfish was landed and sold for human consumption. The number of vessels operating in the fishery has been so small that specific information cannot be disclosed without violating the confidentiality of individual reports. There is a slightly larger groundfish fishery for bait for use by crab boats operating in the area, although fish tickets are not made out systematically when the groundfish are caught or sold. Alaska Department of Fish and Game biologists, extrapolating from a similar bait fishery operating in the Gulf of Alaska, and considering the size of the crab fishery and number of boats known to be catching groundfish for bait in the Bering Sea area, have estimated the harvest for this purpose at about 450 mt in 1977, and as high as 1,300 mt in 1978.

In all, the total domestic commercial groundfish catch in the Bering Sea/ Aleutians region (excluding halibut) is believed to have been no more than 1,500 mt in any recent year.

8.1.2 Domestic Commercial Processing Industry

Although substantial freezing and transshipping facilities are located at Dutch Harbor, with the exception of very small amounts of groundfish frozen for crab bait no groundfish processing (except halibut) has occurred in this region in recent years.

8.1.3 Products and Markets

The viability of a domestic Bering Sea groundfish fishery will ultimately depend on the ability of U.S. industry to market products at prices which cover their production costs. An understanding of these market conditions will be important for the accurate determination of DAH. Although the U.S. and world groundfish markets are not fully understood, it appears that there are not at present significant opportunities to market Bering Sea groundfish at prices which will cover U.S. costs of production. For at least the near term, the domestic groundfish fishery in the Bering Sea will be limited to local markets for bait and to demonstration projects. The market for fishery products is in a state of change, however, and it is entirely possible that new markets could open up in the near future. One possible change might come from management actions taken to deliberately influence market conditions.

It is at least theoretically possible that the determination of OY could influence markets and prices. For any commodity a reduction in supply from one source, such as foreign groundfish landings, may improve market opportunities for other suppliers, such as U.S. fishermen. At present there is no information on whether this relationship is significant for Bering Sea stocks, or whether it might be sufficient to overcome costs of U.S. operations.

Table 18 illustrates the importance of the Northeast Pacific (FAO area 67, including the Pacific Coast above California) in production of pollock, flounders, and cod. In 1975 the Northeast Pacific produced 20% of the world's pollock, 16% of the world's flounders, and 3% of the world's cod. For these groundfish species the likelihood of influencing world price through manipulation of OY is low due to the relatively small share of world production coming from the northeastern Pacific. For example, if the pollock OY for the eastern Bering Sea was to be set 30% below ABC in an attempt

Table 18. 1975 World and Northeast Pacific production of selected groundifsh (metric tons).

	Total	Northeast Pacific (FAO Area 67)	Percentage Produced in Northeast Pacific
Pollock and Saithe	5709117	1117858	20
Flounders	1146276	179145	16
Atlantic and Pacific Cod	2589086	70815	3

to increase the world price for that species, world pollock supply would be reduced by something less than 6% (30% x 20% = 6%). However, for particular markets (e.g., the Japanese market for "surimi", it might be possible for reductions in foreign allocations to have an influence on either price offered for U.S. products or the willingness of customers to consider buying such specific products from U.S. processors.

If it were found that such a relationship did exist, its exploitation would present an additional set of tradeoffs between the management objectives of domestic industry development, consumer interest and price, full utilization of the resource and U.S. foreign policy interests. No such relationship has yet been identified; therefore, no adjustments to OY for this purpose have been made.

Published information on U.S. groundfish utilization and prices is reported in Table 18a. Apparent consumption for any period is a derived figure: the sum of beginning stocks, domestic productions and imports, less ending stocks and exports.

In 1977 U.S. apparent groundfish consumption was 803.4 million pounds, 364 million pounds of fresh and frozen fillets and 438.9 million pounds of sticks and portions. Eighty percent of fillets and essentially all the frozen blocks used in sticks and portions were imported.

1977 retail prices for groundfish fillets ranged from $3.32 per pound for fresh flat fillets to $1.68 per pound for frozen ocean perch fillets. An average price for all sticks and portions was $1.77 per pound. Historically, groundfish prices have risen at a greater rate than general inflation, while prices of substitutes such as beef, pork and poultry have not kept pace.

The distribution of groundfish consumption by region and market type is not available from published sources. However, approximations were obtained by consultation with industry. Over half the stick and portion production is sold to institutions, the remainder is sold to households. Within the institutional category, most fish sticks are sold to such public institutions as schools, hospitals, and military installations, whereas restaurants are the major institutional buyers of fish portions.

Institutions buy an even greater proportion of frozen fish fillets. Within the institutional category, most fillets are sold to restaurants.

On a geographic basis, frozen groundfish consumption is higher in the midwest and south where alternate fish products are not as readily available.

8.2 Recreational Fishery

Historically, there was no recreational fishing in the Bering Sea/Aleutians area; presently, the effort is small, if indeed it exists, and is conducted in inshore waters.

8.3 Subsistence Fishery

Subsistence fishing activities of Native Alaskans in the Bering Sea/Aleutians area pre-date history. To what extent the subsistence effort was conducted in offshore waters can be based only on scant historical reference and oral tradition. The vast majority of these efforts were concentrated on salmon, anadromous char and river herring, taken for the most part by various methods in inshore waters.

Table 18a. U.S. Groundfish Utilization and Prices.

Product and Species	Supplies and Utilization (millions pounds product weight) Beginning Stocks	Domestic Production	Imports	Total	Ending Stocks	Apparent Consumption
Fresh and frozen fillets	53.2	70.7	303.9	427.8	63.3	264.5
Cod	16.2	25.4	122.2	163.8	27.2	136.6
Flatfish (flounder and turbot)	17.6	24.2	95.6	137.4	18.9	118.5
Haddock	5.1	10.5	40.9	56.5	7.7	48.8
Ocean Perch	14.3	10.6	45.2	70.1	9.5	438.9
Sticks and Portions	31.1	(437.8)*	.6	469.4	30.5	438.9
Sticks, Cooked						
Cod						
Haddock						
Pollock						
Whiting						
Portions, raw breaded						
Cod						
Haddock						
Pollock						
Whiting						
Blocks	61.1	4.6	385.1	450.8	73.2	(377.6)*
Cod						
Cod minced						
Flounder						
Haddock						
Pollock						
Pollock, Alaska						
Whiting						
Wolffish						
Total	145.4	75.3	689.6		167.0	803.4**

Table X 1977 U.S. Groundfish Supplies, Utilization and Prices
Source: National Marine Fisheries Service NOAA, Foodfish Market Review and Outlook, December 1977
*Excludes production of sticks and portions from imported blocks.
**Excludes blocks but includes sticks and portions.

tblc18a.bsa gp/fmps

Table 18a. continued

	Prices (cents per pound 1977 dollar)				
	Whole Sale			Retail	
Fresh and frozen fillets	Ex-vessel	Fresh	Frozens	Fresh	Frozen
Cod	25.5	162.3	91.1	253.1	169.7
Flatfish (flounder and turbot)	47.6		116.7	331.5	235.5
Haddock	33.6	161.6	104.9	253.7	185.3
Ocean Perch	15.3		93.1		168.0
Sticks and Portions					177.0
Sticks, Cooked					
Cod			109.1		
Haddock			111.3		
Pollock			74.9		
Whiting			72.3		
Portions, raw breaded					
Cod			109.7		
Haddock			111.7		
Pollock			73.7		
Whiting			70.3		
Blocks					
Cod			97.8		
Cod minced			36.1		
Flounder			95.6		
Haddock			101.4		
Pollock			60.4		
Pollock, Alaska			60.7		
Whiting			54.4		
Wolffish			87.9		

Additional efforts were conducted offshore on halibut and cod. One example of the cod fishery is that of the village of Mekoryuk, on Nunivak Island, where fishing activity offshore was conducted until the late 1940s, when, for reasons unknown, the cod failed to appear in their accustomed waters. As a consequence, that fishery does not exist at the present time. The bulk of the subsistence effort offshore was directed against otter, seal, sea lion, walrus, polar bear and birds and eggs inhabiting islands and rocks.

8.4 Indian Treaty Fishery

No Indian (Native Aleut-Indian-Eskimo) treaty fishing rights are reserved in the Fishery Conservation Zone.

8.5 Area Community Characteristics

Profiles for over 100 Alaskan coastal communities, several of which are located in or near the Bering Sea/Aleutians region, are available for reference at the following sites:

North Pacific Fishery Management Council headquarters, Anchorage, AK

National Marine Fisheries Service, Alaska Regional Office, Juneau, AK

National Marine Fisheries Service, Northwest Regional Office, Seattle, WA

Alaska Department of Fish and Game headquarters, Juneau, AK

A sample community profile is shown in Appendix I.

8.6 Interaction Between User Groups

8.6.1 Trawl vs. Halibut

The halibut fishery in the Bering Sea and Aleutians is affected by domestic fisheries for crab and shrimp and by foreign fisheries for groundfish. The kind of impacts include destruction of gear, preemption of fishing grounds, and a reduction in abundance that results from the incidental capture of halibut. The North American setline catch peaked in 1963 at 4,900 mt but has been below 500 mt since 1972.

The effects of current domestic operations on both the halibut fishery and resource are less than those of foreign fisheries. Gear conflicts are minimal, and the annual incidental catch of halibut by domestic trawlers is probably less than 100 mt (however, domestic king crab and shrimp fisheries may take incidentally up to 1,000 mt of halibut). A greater impact on the halibut fishery could occur if domestic effort toward groundfish increases.

Regarding foreign fisheries, halibut fishermen occasionally report instances of gear destruction or preemption of grounds. The most important effect of foreign fishing is that of incidental catches. Foreign vessels target on species other than halibut but halibut are taken incidentally in substantial numbers; although regulations require that halibut be released, most die from injuries received during capture.

Hoag and French (1976) used data collected by observers on Japanese trawlers to examine the incidental catch of halibut. The average incidence and size during 1969-1974 is shown by area and month in Table 19. The incidence was highest in the southeastern Bering Sea in the winter and spring. The majority of the halibut were 3 to 7 years old and less than 5 kg. More recent data from observers (Hoag and French, ms.) show a similar seasonal picture, although the rate of incidence is lower because critical areas have been closed to trawling. In February and March 1978, observers were, for the first time, aboard two Japanese longline vessels fishing the southeastern Bering Sea. Their data show that when the longliners fished in shallow water (220-320 m) for Pacific cod the incidence of halibut became extremely high (30 halibut per mt of catch; about 14% by weight). The incidence was much lower (1.5 halibut per mt) when the vessels fished in deeper water (500-620 meters) and the target species were Greenland turbot and sablefish. The average weight of halibut was about 5 kg and the observers reported that most of the halibut were released alive.

Hoag and French (1976) estimated the annual incidental catch of halibut by the Japanese and Soviet trawl fisheries from 1954 to 1974. Their estimates show that the total incidental catch in the Bering Sea peaked in 1971 at 11,500 mt but then dropped to about 5,800 mt in 1974. However, about one-third to one-half of this catch occurs in the western Bering Sea and may have only limited effect on the North American fishery. Since 1974, foreign trawling has been prohibited in specific areas of the southeastern Bering Sea during the winter and spring to reduce the incidental catch of halibut. These closures along with a reduction in fishing effort have sharply reduced the incidental catch. Preliminary projections indicate that the incidental trawl catch in the eastern Bering Sea has declined from about 7,000 mt in 1971 to less than 2,000 mt in 1976.

The incidental catch of halibut in the Aleutians is much less than in the Bering Sea, probably around 500 mt.

Hoag (1976) used estimates of the incidental halibut catch and assessed the effect of trawling on the North American setline fishery. The results showed that trawling reduced the survival of juvenile halibut and, therefore, recruitment to the setline fishery. Because the incidental catch consists of juvenile halibut, the yield loss to the setline fishery occurs for many years after a given incidental catch, i.e. over the projected lifetime of the fish in the setline fishery. Also, the magnitude of the eventual loss is about 20 percent greater than the magnitude of the incidental trawl catch itself because growth exceeds natural mortality at young age. In the eastern Bering Sea, the estimated annual yield loss in recent years has been about 5,000 mt and represents over 95% of the total potential catch (i.e. of the total potential production, setlines take less than 5 percent). The recent reductions in the incidental catch will not significantly benefit the setline fishery for several years.

In 1977, the average incidence rate for halibut in all foreign trawl fisheries is estimated to have been 0.267 individuals per metric ton of total groundfish catch; average weight of incidentally caught halibut was 8.99 kg.

8.6.2 <u>Trawl vs. Crabs</u>

U.S. observers aboard foreign trawlers sample the catch prior to sorting by species and count the number of crabs in each sample per unit weight of the entire sample. This provides an incidence rate, expressed as number of crabs per metric ton of total catch. Average incidence rates for particular statistical areas and quarters are then multiplied by the corresponding total catch of each country, and summed over quarters to arrive at an estimate of total incidental crab catch, by nation, for the year.

Table 19. The average incidence and weight of halibut in Japanese trawls in the Bering Sea, by month and area, 1969-1971.

Month	A	B	C	De	Dw	E
			Incidence (number per metric ton)			
January	--	--	0.054	--	0.070	25.437
February	0.163	--	2.787	--	0.196	2.629
March	5.779	4.930	0.476	--	0.720	8.073
April	2.935	1.341	1.465	--	0.012	2.516
May	7.145	6.976	1.022	--	0.131	3.062
June	--	0.000	1.155	--	1.114	1.987
July	--	--	0.040	0.013	0.066	0.000
August	0.021	--	0.157	0.013	0.103	--
September	0.008	0.000	0.187	--	0.007	--
October	0.018	0.000	0.023	--	-.037	0.022
November	0.064	--	--	--	0.049	1.266
December	0.014	--	0.249	--	0.074	27.643
			Average size (kg)			
January	--	--	3.20	--	2.28	0.39
February	0.69	--	1.14	--	5.90	1.07
March	0.93	0.81	1.46	--	2.66	0.48
April	0.93	0.80	1.00	--	0.68	1.33
May	0.64	0.41	1.22	--	1.59	1.13
June	--	--	2.76	--	6.11	1.94
July	--	--	3.01	3.50	7.45	--
August	17.73	--	7.42	3.50	2.03	--
September	7.30	--	3.68	--	4.44	--
October	3.55	--	8.70	--	4.70	2.38
November	1.33	--	--	--	5.15	2.17
December	0.66	--	5.37	--	2.57	0.85

Before 1977, U.S. observers were only aboard Japanese independent stern trawlers (large trawlers) and groundfish motherships. No valid technique was available for extrapolating incidence rates observed in those two fleets over the Japanese landbased dragnet (small trawlers), Soviet, or Korean trawl fleets. In 1977, however, all fleets were observed and estimated incidental catches of crabs are as follows (number of crabs):

Country	King Crab	Tanner Crab
Japan	583,400	17,446,000
USSR	1,200	3,500
ROK	11,200	54,000
Total	595,800	17,503,500

Between 65 and 70 percent of the incidental Tanner crab catch was C. opilio. Incidence rates for both king and Tanner crabs were highest in the Japanese landbased dragnet fleet.

To provide some insight into recent trends, estimates of incidental crab catches by the Japanese mothership and independent stern trawl fleets during 1973-77 are (number of crabs):

Year	King Crab	Tanner Crab
1973	465,600	112,000,000
1974	489,900	155,000,000
1975	155,900	60,000,000
1976	?	26,000,000
1977	297,300	9,600,000

In 1977, the average incidence rate for king crabs in all foreign trawl fisheries is estimated to have been 0.481 individuals per metric ton of total groundfish catch; average weight of incidentally caught king crabs was 1.15 kg. Comparable values for Tanner crabs are estimated to have been 12.970 individuals/mt and 0.33 kg average weight.

8.6.3 Trawl vs. Salmon

Using the same sampling methods as for halibut and crabs, data collected by U.S. observers produced the following estimates of incidental salmon catches in 1977:

Country	Total Number of Salmon
Japan	23,890
ROK	23,798
USSR	42
Total	47,730

Of this total, 91% were chinook salmon (O. tshawytscha) and 9% chum salmon (O. keta).

In 1977, the average incidence rate for salmon in all foreign trawl fisheries is estimated to have been 0.030 individuals per metric ton of total groundfish catch; average weight of incidentally caught salmon was 4.0 kg.

8.6.4 Trawl vs. Sablefish Longlines and Pots

Japanese longline fishermen report that the trawl fishery has expanded geographically and bathymetrically to the point where traditional sablefish longline grounds have been pre-empted. If the condition of sablefish stocks in this region improve to the point where they could support a viable domestic fishery (see Section 9.6), the stated interest of U.S. fishermen for developing a longline and pot fishery for that species could be thwarted by the risk of gear conflicts with trawlers unless gear separation measures are affected.

8.6.5 Foreign vs. Domestic Trawling

With the exception of a very small crab bait fishery, no domestic trawling has taken place in the region. Many U.S. fishing interests perceive the presence of fleets of large foreign trawlers as a de facto impediment to the development of a domestic groundfish trawl fishery in the Bering Sea because of the possibility of: (l) preemption of favored grounds by concentrations of foreign vessels that are 2-3 times the size of the largest U.S. trawlers, and (2) competition for fish by foreign vessels that can apparently operate successfully at levels of abundance and average fish sizes that are less than that required for economic operation of domestic trawlers. (See also Section 10.4).

8.7 Revenues Derived from Fishery

Federal revenues are based on charges placed on foreign fisheries, while state (Alaska) revenues are based on fees and taxes placed on the domestic fishery.

8.7.1 Federal Revenues

A summary of U.S. revenues expected in 1978 from charges placed on foreign nations fishing for groundfish within the FCMA zone in the Bering Sea/ Aleutians area is presented below:

Expected Revenue from Foreign Nations, Bering Sea/Aleutians, Groundfish, 1978

	Total	Source of Dollars			
Type of Revenue	Dollars	Japan	U.S.S.R.	R.O.K.	Taiwan
Income - vessel fee	566,700	226,000	269.500	65,800	4,800
Income - poundage fee	7,230,600	4,995,400	2,012,900	202,400	19,900
Reimburseable income (U.S. observer cost)	294,100	224,900	54,500	14,700	--
Fines and penalties	--	--	--	--	--
TOTAL	8,090,800	5,446,300	2,336,900	282,900	24,700

Revenues from vessel and poundage fees total $7,796,700 for 1978. Reimbursable income (to cover the cost of placing U.S. observers aboard foreign fishing vessels in the Bering Sea/Aleutians area) is tentatively estimated at $294,100. Fines and penalties are tied to violations and are, therefore, variable income items. The expected total federal revenue for 1978 is around $8,090,800.

8.7.2 State Revenues

Aside from the halibut fishery, virtually no domestic groundfish fishery has existed in the Bering Sea/Aleutians area in recent times. The approximate state revenues derived from the fishery in 1977 are presented below:

Type of Revenue	State-wide Total, 1977 1/	Bering Sea/Aleutians Groundfish Fishery: Halibut	Bering Sea/Aleutians Groundfish Fishery: Other
	(DOLLARS)		
Raw fish tax	3,830,280	5,000	*
Cold storage tax (including freezer ship)	2,372,785	5,000	*
Vessel and gear license	654,220	200	*
Commercial fish licenses	430,836	50	*
TOTAL	7,288,121	10,250	*

* negligible to none

1/ Source: Alaska State Department of Revenue

9.0 BIOLOGICAL AND ENVIRONMENTAL CHARACTERISTICS OF THE FISHERY

9.1 Life History Features and Habitat Requirements

This section summarizes habitats and life histories of the different groundfish species of commercial importance in the Bering Sea. More detailed information can be found in the following: Bakkala and Smith (1978), Bakkala (1981), Best (1981), Carlson and Haight (1976), Carlson and Straty (1981), Garrison and Miller (1982), Gusey (1979), Hart (1972), Hood and Calder (1981), Lewbel (1983), Morris (1981), National Marine Fisheries Service (1979, 1980), Pereyra et al. (1976), Quast (1972), Smith (1981), Wilson and Gorham (1982), and Wolotira (1977).

9.1.1 Walleye pollock

This species is the most abundant species on the continental shelf, representing 20-50 percent of the total standing stock of groundfish. 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. 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, and over deep water where bottom temperatures are relatively warmer. As temperatures on the shelf become warmer in spring, part of the walleye pollock population moves to shallower waters (90-140 m) where spawning takes place. They first reproduce at the age of 3 or 4 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. Walleye pollock eggs hatch in 2 to 3 weeks, depending on temperature; larvae remain in surface waters. 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.

9.1.2 Pacific cod

This species is 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 seasonal migrations between the continental slope and shelf, and along the continental slope. Spawning begins in January, 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 semi-demersal and feed on benthic epifauna, planktonic crustaceans, and fish. Pacific cod are utilized as food by northern fur seals, halibut, belugas, and sperm whales.

9.1.3 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) which 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. In late autumn, the fish 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 through the water column. Spawning takes place predominantly in June and July on the inner shelf with females releasing from 1,000,000 to 3,000,000 pelagic eggs, which accumulate in central areas of well-developed gyres. The larvae are pelagic for 4 to 5 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.

9.1.4 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, crustaceans, and squids.

9.1.5 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 the 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 primarily upon benthic crustaceans, fish, and squid. 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.

9.1.6 Pacific ocean perch

The species is common in and along canyons and depressions on the upper continental slope. The most dense 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 5 to 8 mm at birth and live a planktonic existence for an undetermined period of time. The juveniles (ages one to five) feed mainly on copepods and euphausiids; adults on euphasiids, copepods, fish, and squid.

9.1.7 Other rockfishes

These include rougheye rockfish, dusky rockfish, northern rockfish, shortspine thornyhead, shortraker rockfish, dark blotched rockfish, yelloweye rockfish, and blue rockfish. Rockfishes 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.

9.1.8 Sablefish

This species occupies the water column from the surface to a depth of 1200 m and is most abundant between 100-1000 m on the outer continental shelf and continental slope, where 15 to 20 percent of the total species biomass is located. Some sablefish undertake 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.

9.1.9 Atka mackerel

This species occurs in the Bering Sea from the Aleutian Islands to Cape Navarin. It spawns near the bottom, 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 demersal 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.

9.1.10 Squid

Several species of squid inhabit the Bering Sea seasonally, wide ranging in distribution. The exact nature and size of the resource are poorly defined, but they are generally thought to be large and mobile. Squid live at both mid-water and near surface depths. Spawning, for some species, may extend from spring to fall; sexual maturity may be reached in 2 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.

9.1.11 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 release up to 2,000,000 pelagic eggs. Larvae are also pelagic until reaching a length of about 10 cm after about 6 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.

9.2 Stock Units

The groundfish and squid resources considered in this Plan consist of species that are wide ranging in their general distribution, occurring in the eastern Bering Sea, Aleutians waters, and in the Gulf of Alaska. Within each of these major geographical regions separate stocks or populations of these species may exist, but our state of knowledge is such that we cannot be certain of this possibility for most species. Research results and fisheries information indicate that for most species resident stocks exist in each major region (E. Bering Sea, Aleutians, and Gulf of Alaska). For other species, such as Pacific halibut and those of squid, this may not be the case.

Those species that are generally considered to have separate stocks residing in the Aleutians as well as the eastern Bering Sea are pollock, yellowfin sole, sablefish, Atka mackerel, Pacific ocean perch, Pacific cod, Greenland turbot, arrowtooth flounder and various species of sole.

For pollock the eastern Bering Sea stock is larger than that of the Aleutians. There has also been some speculation that in the eastern Bering Sea proper, this species may be further subdivided into a northern and a southern stock, primarily because spawning concentrations have been found north as well as south of the Pribilof Islands. (Japan Fishery Agency 1974 b). However, it is difficult to confirm such a separation since there apparently is a considerable amount of mixing of fish through seasonal north-south movements as evidenced from tagging studies.

Tagging studies indicate the existance of separate spawning stocks for eastern Bering Sea yellowfin sole, one of which resides in waters north of a line between the Pribilof Islands and Cape Avinof and another south of this line, with only a limited exchange between them (Wakabayashi 1974). Studies of differences in growth rate, meristic features, and genetic characters, however, have not been conclusive (Wakabayashi et al. 1977). Furthermore, U.S. researchers estimate that about 90% of the total yellowfin sole biomass of the eastern Bering Sea lies in the southern stock area, making the question of less practical importance. Therefore, until more definitive results are obtained, all yellowfin sole of the eastern Bering Sea will be considered as belonging to one stock.

Adult sablefish live mainly in offshore waters at bottom depths of 200 meters and greater throughout their geographical range. Their movements appear to be localized from tagging studies which show that most recovered fish have been taken in the same general area where they had been tagged and released (Low 1977). A few tagged fish, however, have been recovered a considerable distance from their area of release, and some of these movements have been between major geographical areas, such as the Gulf of Alaska and Bering Sea. These extensive movements, although few, demonstrate that some exchange of fish between major areas does occur, and that separate stocks, if they do exist, may be biologically closely related. At this stage of our knowledge it may be best to consider sablefish as being comprised of separate stocks throughout its geographical range, but that minor intermixing of the stocks does occur. For managing fisheries on these stocks, it may be convenient to treat these stocks as four major and distinct groups; an eastern Bering Sea group, an Aleutians group, a Gulf of Alaska group, and a U.S. west coast group.

There is some circumstantial evidence that Atka mackerel may be comprised of localized stocks throughout its geographical range which includes waters off Kamchatka and the Aleutians, and the eastern Bering Sea and western Gulf of Alaska. The species seeks certain bottom areas for spawning and will return to these areas year after year to reproduce (Rass 1970). Only a few of these areas have been determined, but it is likely that more exist and the spawning concentrations associated with each probably should be considered to be discrete stocks. Until more precise evidence of the location of specific spawning areas becomes available, concentrations in the Aleutians area, the eastern Bering Sea area, and the western Gulf of Alaska will be assumed to comprise separate stocks.

For Pacific ocean perch, differences in biological features (e.g., growth rate) between eastern Bering Sea and Aleutian fish suggest that each of these areas has its own unique stock (Chikuni 1974).

Evidence for the separation of other principal groundfish species (cod, turbot, flathead sole, rock sole, and plaice) is not available, but as a conservative measure, each of these species will be considered to be comprised of separate stocks in the Aleutians and eastern Bering Sea.

Available evidence suggests significant movement of halibut between the eastern and western Bering Sea and between the eastern Bering Sea and the northeastern Pacific Ocean (Best 1977, Dunlop et al. 1964). Circulation patterns indicate that eggs and larvae spawned in the eastern Bering Sea should remain within the Bering Sea. However, the cyclonic circulation in the area will transport eggs and larvae in a northwesterly direction and the current is sufficient to transport larvae to the Asian Coast. It is also likely that larvae originating in the Gulf of Alaska are transported into the Bering Sea.

Large numbers of juvenile halibut inhabit the eastern Bering Sea, and this region may serve as a nursery ground for other regions. Recoveries of tagged juveniles are meager but indicate a movement into the Gulf of Alaska. One juvenile tagged west of the Pribilof Islands was recovered in southeastern Alaska five years later. Tagging data are more extensive for adult halibut and show movements as far south as northern California; Dunlop et al (1964) estimated an emigration rate of 24% over a 7-year period. Tagging also indicates movements from the Gulf into the Bering Sea and between eastern and western Bering Sea, but these movements appear to be relatively infrequent.

In the Aleutians, tagging and other studies indicate that the halibut in the region are an intermingling component of stocks in the Gulf of Alaska and British Columbia (Bell 1967). The total amount of bottom area suitable for halibut in the Aleutians is small and the overall productivity of the region is much less than in the Bering Sea and other regions of the northeast Pacific. Nevertheless, halibut are sufficiently concentrated in local areas to provide good catches for a few vessels.

Squid resources of the eastern Bering Sea and Aleutians waters are believed to be mainly comprised of five species that are wide ranging in their distribution in nothern waters. Four of these species (Gonatus fabricii, Gonatus magister, Gonatotopsis borealis, and Morotenthis robustus) inhabit the near surface and mid-waters of the other continental shelf and beyond the shelf. The other species (Rossia pacifica) prefers inshore waters where it forages throughout the water column. All these squid species are, therefore, much more mobile than most of the groundfishes and apparently roam quite freely throughout their range. Because of this capability, it is assumed that there is considerable intermingling of individuals from different regions; hence, each squid species may be considered as having one interbreeding population common to the Bering Sea, Aleutians, and the western Gulf of Alaska.

9.3 Data Sources

9.3.1 Catch and Effort Data

Catch and effort statistics are collected on a continuing basis from two main sources: from the commercial fishery and from research surveys. Commercial fishery data are used mainly to compute CPUE trends to monitor the relative abundance of stocks under exploitation. In addition to CPUE computation, trawl survey information can also be used to estimate standing stocks. Commercial fishery data of sufficient detail and precision for Bering Sea/ Aleutians stock assessment studies are:

(1) Catch and effort statistics of the Japanese mothership, longline- gillnet, and North Pacific trawl and land-based trawl fisheries, as provided through INPFC;
(2) Catch and effort statistics collected by U.S. observers stationed aboard foreign vessels.

Under the FCMA, similar types of rather precise catch and effort statistics will soon become avaialable from all nations participating in this region's groundfish fishery.

Catch and effort statistics are also obtained from research trawl surveys conducted by the United States' National Marine Fisheries Service, Fishery Agency of Japan, and the International Pacific Halibut Commission. Data from the Fishery Agency of Japan are made available to the U.S. in publications, the INPFC and during bilateral scientific meetings. The International Pacific Halibut Commission conducts an annual assessment of juvenile halibut abundance in the Bering Sea which provides catch and effort information concerning not only halibut but many other groundfish species as well.

Statistics from Japanese fishing operations have been among the most detailed and complete of any nation in the world. In general, they are by species, ½° Latitude by 1° Longitude statistical areas, month, gear type, and vessel class. An exception however, has been Japan's land-based trawl fishery from which the available statistics have been less timely and in less detail. This appears to reflect the fact that they have been collected at the provincial level in Japan rather than by the Fishery Agency of Japan, as has been the case for the other fisheries.

Although improving since the early 1970's, statistics provided by the U.S.S.R. have generally reflected only gross catches of imprecise species groupings for very large statistical areas. Until very recently, effort information has either been lacking entirely or in a form that had little utility for assessing relative abundance (e.g., catch per tow without reference to tow duration).

As regards other nations fishing for bottomfish in the Bering Sea/Aleutians Region, Poland has provided statistics in detail comparable to those of Japan for its very limited fishery. Since 1968, South Korea has conducted a growing groundfish fishery in the Region but no statistics concerning it are available for the period prior to 1976 and those acquired since have been incomplete. Operations by Taiwanese vessels have been few and no statistics have yet been reported.

For status of stock evaluations, the catch and effort data bases generally relied upon are those of the Japanese fisheries, and research surveys conducted by Japan, the United States, and IPHC.

9.3.2 Biological Data

Biological data concerning Bering Sea/Aleutians groundfish resources are collected on a continuing basis from the commercial fishery and from research surveys. Those from the commercial fisheries have generally been limited to length-frequency samples from the Japanese fisheries until U.S. observers were placed aboard foreign vessels to sample the catch. The observer program covers a significant portion of the several foreign fishing fleets and has been constructing an extensive data base on length, weight, age and sex of the principal species taken by foreign fisheries.

The most comprehensive source of biological information is that collected during trawl surveys conducted by the United States' National Marine Fisheries Service. In these surveys, length, weight, age, and sex information and at times, sexual maturity and stomach content data, are collected for all species encountered during the surveys. Annual research surveys conducted by the Fishery Agency of Japan and the Soviet Pacific Scientific Research Institute of Fisheries and Oceanography have also provided excellent sources of information on life history, abundance, and distribution of principal species.

9.4 Quality of Data

To be most useful in the evaluation of stock condition and sustainable yield, data from the commercial fisheries should include the catch by species and the quality and quantity of effective effort expended to take this catch; they should be provided for relatively small geographical areas and time periods. In this way trends in catch and standardized catches-per-unit-of-effort (CPUE) can be monitored by precise time-area units so reliable inferences may be drawn concerning stock abundance. In addition, biological sampling should be adequate to estimate size and age composition of the catch, by time and area. These basic fisheries data (catch, effective effort, age and size composition) provide much of the input for determining mortality rates, relative year class strength, changes in stock density, recruitment, and other population characteristics upon which the condition of stocks can be measured.

Japan provides very detailed statistics on her fisheries (see Section 9.3), but even these are deficient in terms of fishing effort, age and size data, and completeness in reporting catches by species. The fishing power of the Japanese fleet has increased because of increases in vessel horsepower, improvements in fish detecting and harvesting gears, and experience acquired by the fishermen of the grounds, making difficult (perhaps impossible) adjustments to the reported nominal effort to reflect true fishing power. There is also the problem of determining what proportion of the total fishing effort was expended on each major species.

Until recent years data on size composition of the principal species harvested by Japan were insufficient because of incomplete areal and seasonal coverages, and the lack of associated age data to accompany the size information.

The U.S.S.R. has had a very poor history of reporting on her fisheries. There was virtually no breakdown of the catch by statistical areas that is useful in stock assessment nor were there data on the age and size composition of the catch. Likewise, data provided by other nations have virtually no utility for stock assessment purposes.

The problem of inadequate detail of commercial fishery information has been partially solved as the U.S. observer program has expanded in scope to sample the foreign commercial catch. This program is also addressing the question of the accuracy and precision of reported catch data.

In addition to the observer program which provides a reliable source of catch, effort, and biological data, research vessel surveys provide an independent and, at times, less biased means of estimating the condition of groundfish stocks. The surveys are conducted in such a manner that estimates of age and size composition and other population characteristics can be obtained for the resource complex as a whole within the survey area, whereas commerical fisheries often concentrate on certain species, sizes of fish, and specific areas. Since research surveys can be done in a standardized manner, CPUE from the surveys serves as a very meaningful indicator of changes in fish density by time and area. Furthermore, surveys of juvenile or pre-recruit fish can best be done by means of research surveys; such surveys provide one of the few means by which predictions of incoming year class strengths can be obtained. There is also the relatively new approach of assessing stock size by acoustical sounding.

The main deficiency in existing survey data is the lack of areal coverage. Because of limitations in budget and physical aspects of the gear and vessels, the deeper waters (greater than 200 m) are generally not surveyed. Therefore, portions of the stocks of deep water flounders (arrowtooth flounder and Greenland turbot), sablefish, Pacific ocean perch and even pollock are not fully sampled. What the research surveys lack in coverage, however, is made up in detail which augments the broader but less precise data base obtained from the commercial fisheries.

9.5 Ecological Relationships

9.5.1 Environmental Characteristics

The Bering Sea shelf, with an area of some 1 million km2, is about twice the size of that of the Barents Sea or the North Sea. On the average, it is slightly deeper than the North Sea but shallower than the Barents Sea. The bottom is trawlable over most of the shelf. The Aleutian Island shelves are relatively narrow and rocky, similar to that of the Gulf of Alaska.

Relatively weak tidal currents dominate the Bering Sea shelf. The permanent flow is sluggish and, therefore, the exchange of water masses between shallow and deep areas is very slow. On the other hand, the tidal currents around the Aleutian Islands are relatively strong and strong semi-permanent currents flow through the passes between the islands, effecting the water exchange between the deeper part of the Bering Sea and the central North Pacific.

Central and northern parts of the Bering Sea shelf are ice covered part of the year. Due to the absence of temperature and salinity stratification in the waters over the shelf during autumn and winter, cold water (0°C) is formed there under the ice from surface to bottom. This cold water on the bottom can persist until mid-summer and affects the distribution and migrations of demersal fish.

The annual range of temperature change over the Bering Sea continental shelf (from surface to about 150 m depth) can exceed 10°C. Over deep water near the Aleutian chain this annual change is less than 5°C. There is a subsurface temperature maximum of about 3.5°C, with associated high salinity, at a depth of about 150 m in the whole region under consideration. The areas along the continental slope, where this warmer subsurface layer intercepts the slope, are important overwintering areas for many demërsal and even some pelagic fish (e.g. herring).

Of the oceanographic processes and their year-to-year variations, the following are the most significant in respect to the biota: (1) year-to-year variation of ice cover in the central and south-central part of the Bering Sea shelf; (2) the autumnal turnover of water masses on the shelf (returning nutrients from deeper layers and near the bottom to surface layers); (3) considerable monthly surface layer temperature anomalies (up to 3°C) in the central and southern Bering Sea; (4) formation of subzero bottom temperatures on the Bering Sea shelf; and (5) rapid flushing of the Aleutian Island shelves.

9.5.2 Biological Characteristics

The Bering Sea is a typical high latitude area, with relatively few species, among which some dominate quantitatively to a high degree over the others. In scarcely any other ocean region is one fish species quantitatively so dominant as pollock in the Bering Sea. Rather pronounced cannibalism occurs in dominant species in general and cannibalistic interactions cause long-term quantitative changes in the ecosystem complex.

The most pronounced biological characteristic of the Bering Sea and Aleutian Islands are is the presence of large numbers of marine mammals (e.g. 1.4 million fur seals alone) and birds (ca. 10 million shearwaters arriving each summer), which consume together at least as many fish as the commercial catch of all nations from this region.

Another basic biological characteristic of the Bering Sea is the presence of benthos on the extensive continental shelf, providing a food source (and support) for flatfish communities and for commercially exploitable crabs. The abundant benthos in the northern half of the Bering Sea contains, however, little "fish food"; most of it is made up of large, hard shelled clams. This northern benthos is similar to other high-latitudes benthos, where a phenomenon called "successive accumulation of generations" occurs.

A fourth general biological characteristic of the Bering Sea/Aleutians region is the relatively high basic organic productivity. This high productivity is largely caused by deep autumn/winter turnover which returns regenerated nutrients to the surface layers. This high organic production (combined with relatively slow decomposition rate of organic detritus in colder waters) causes the presence of a high standing crop of larger zooplankters (euphausids) and boreal squids (gonatid squids), which in turn serve as an important food source for fish (and partly for mammals and birds). Thus, several semi-demersal fish species (e.g. pollock, rockfishes, etc.) are less dependent upon benthic food and can live a pelagic life over deep water in the Bering Sea/Aleutians region.

9.5.3 Ecosystem Characteristics

In the marine ecosystem there are intensive interactions between different species, their prey items, and environmental factors. Changes in abundance and distribution of one species (e.g. caused by fishery) affect the abundance and distribution of other species as well. Therefore, wise fisheries management requires the quantitative knowledge of all of these interactions; single species population dynamics' approaches are no longer fully adequate for modern fisheries management.

The quantitative processes in the marine ecosystem are beginning to be simulated and studied with numerical, dynamic, deterministic marine ecosystem reproduction models. A few results, pertinent to management of the Bering Sea groundfish fishery are presented briefly in this section. These results originate from the Dynamical Numerical Marine Ecosystem Model (DYNUMES III), currently in use at the Northwest and Alaska Fisheries Center, Seattle.

The DYNUMES III model permits the determination of equilibrium biomasses of individual species and groups of species (Table 20). Individual biomasses have also been calculated for both the juvenile and exploitable portions of populations (Figure 21). It is of interest to note that the total biomass of, for instance, all finfish varies but little from one year to another in a given region, but individual species can have considerable long-period fluctuations (periods usually larger than 10 years) in abundance, whereby some species incline and others decline in abundance.

The DYNUMES model permits the computation of the main component of "natural mortality"--i.e. grazing and the determination of the portions grazed, for instance, by mammals and by other fish (Figure 22). Grazing (consumption) is computed in trophodynamic computations. The results also allow the computation of annual turnover rates of the biomasses (Table 20).

In ecosystem sense, there is no "surplus" production in the sea for man to take. The question is mainly one of balance between ecosystem components, i.e. changes in target species biomasses and the resultant changes in the biomasses of pray, predator, and competitor species. The determination of such fishery-induced changes is one of the major objectives of the DYNUMES model.

The results of conservative computations of the consumption of fish and other ecological groups by marine mammals and birds in the eastern Bering Sea are given in Table 21 (the computations are conservative in the sense that the lowest estimates of the number of mammals and their food requirements were used). The results show that mammals consume more than twice as much finfish as is taken in the total commerical catch. This strongly implies that finfish yield is at least as much a function of marine mammal abundance as it is a function of the finfish fishery itself.

The DYNUMES model shows that an intensive fishery can be, in some cases, beneficial to the production of biomass. Adult pollock are cannibalistic on juvenile pollock. The growth rate of juvenile fish, which feed mainly on euphausids, is considerably higher than the growth rate of older fish. When an intensive fishery removes older, cannibalistic pollock, the grazing pressure on juveniles is relieved and productivity of the pollock biomass, at large, is enhanced. The model also indicates that in an underexploited population, cannibalistic interaction would result in a self-generating cycle of pollock abundance with a period of about 12 years.

Intraspecific cannibalism, as well as interspecific predator-prey relations cause a partial spatial separation of juveniles and adults (see Figures 23-24).

Table 20. Biomass, annual consumption, annual turnover rate, and relative monthly consumption of different species and/or ecological groups in the eastern Bering Sea, as computed with DYNUMES II.

Species/ecological group	Mean biomass (B) 10^3 tons	Annual (C) consumption 10^3 tons	Annual turnover rate C	% of Biomass consumed per month
Pollock	8,235	5,820	0.7	5.8
Herring	3,260	2,970	0.9	7.7
Other pelagic fish	6,870	6,595	1.0	8.7
Yellowfin sole	1,475	866	0.6	4.9
Other Flatfish	2,030	1,630	0.8	6.7
Other gadids	2,840	2,680	0.9	8.1
Other demersal fish	2,550	2,790	1.1	9.0
Total finfish	27,260	23,350	0.86	
Squids	4,050	3,020	0.75	6.4
Benthos	25,600	19,730	0.77	6.3
Zooplankton		83,970		
Phytoplankton		(52,500)		

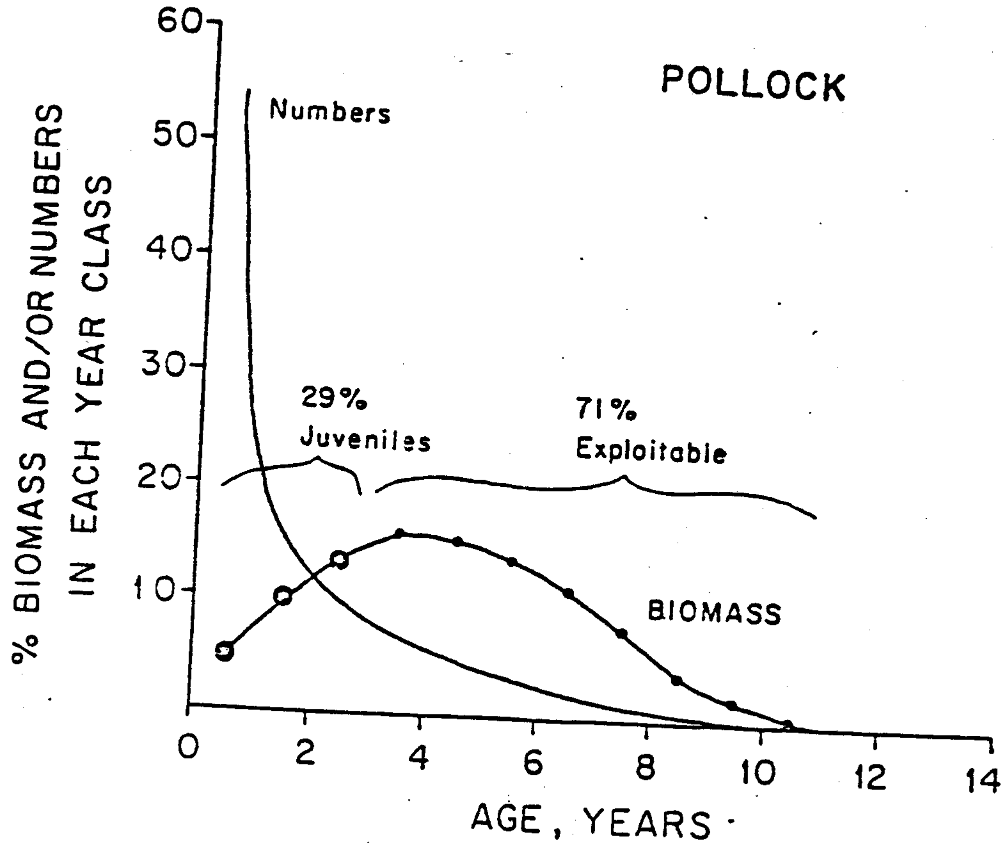

Figure 21--Distribution of biomass and numbers of walleye pollock within different year classes (% of total).

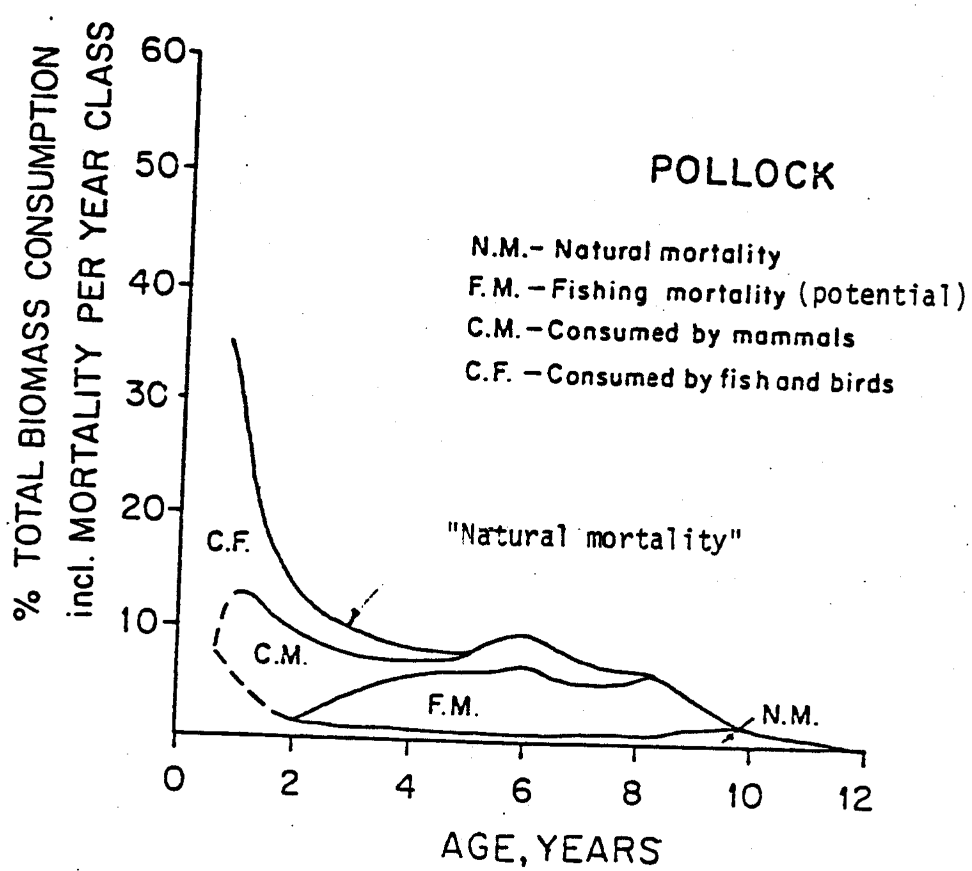

Figure 22.--Distribution of "consumption" with age of walleye pollock, as percent of total biomass.

Table 21--Annual consumption by marine birds and mammals in the eastern Bering Sea (in 10^3 tons), as computed with DYNUMES II ("conservative" inputs).

Species/group of species	Species/group of species consumed										
	Herring	Other pelagic	Salmon	Pollock	Other gadids	Flatfish	Total finfish	Zooplankton	Squids	Benthos	"Others" (Unspecified)
Marine birds	11.7	40.3	1.5	26.3	+	1.9	81.7	105.2	13.2	2.8	14.3
Fur seal	26.5	8.8	8.8	322.3	22.1	-	388.5	-	44.2	-	8.8
Sea lion	16.8	11.2	22.4	182.2	19.6	-	252.2	-	+	-	+
Bearded seal	25.0	25.0	8.3	83.5	41.7	41.7	225.2	-	66.8	509.2	33.4
Harbor seal	66.9	31.2	6.7	89.2	13.4	8.9	216.3	-	89.2	104.8	13.4
Ringed/ribbon seal	24.2	47.5	3.0	84.7	30.3	-	189.7	-	30.3	+	9.1
Walrus	+	+	1.6	6.6	+	4.9	13.1	-	+	311.4	3.3
Total pinnipeds	159.4	123.7	50.8	768.5	127.1	55.5	1,285.0	-	230.5	925.4	68.0
Baleen whales	20.7	27.7	-	13.8	6.9	-	69.1	1,189.3	124.5	-	+
Toothed whales	231.5	408.5	0.5	340.4	68.1	68.1	1,117.1	-	-	-	245.1
Total, whales, porpoises, dolphins	252.2	436.2	0.5	354.2	74.0	68.1	1,186.2	1,189.3	124.5	-	245.1
Total by birds and mammals	423.3	600.2	52.8	1,149.0	201.1	125.5	2,552.9	1,294.5	479.5	928.2	327.4

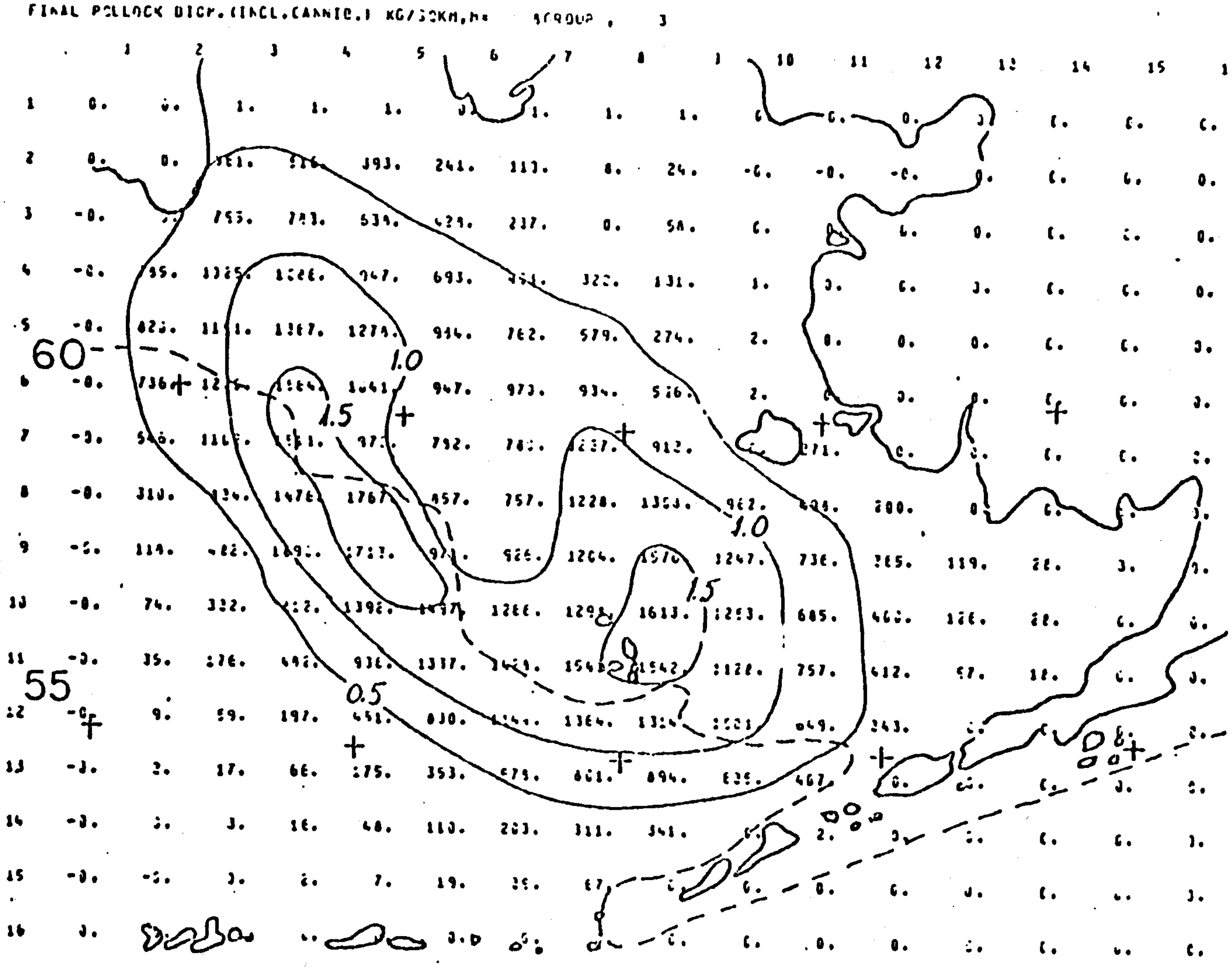

Figure 23 --Distribution of group 3 pollock (35 cm long) in August, computed with DYNUMES II (isopleths in mt/km^2).

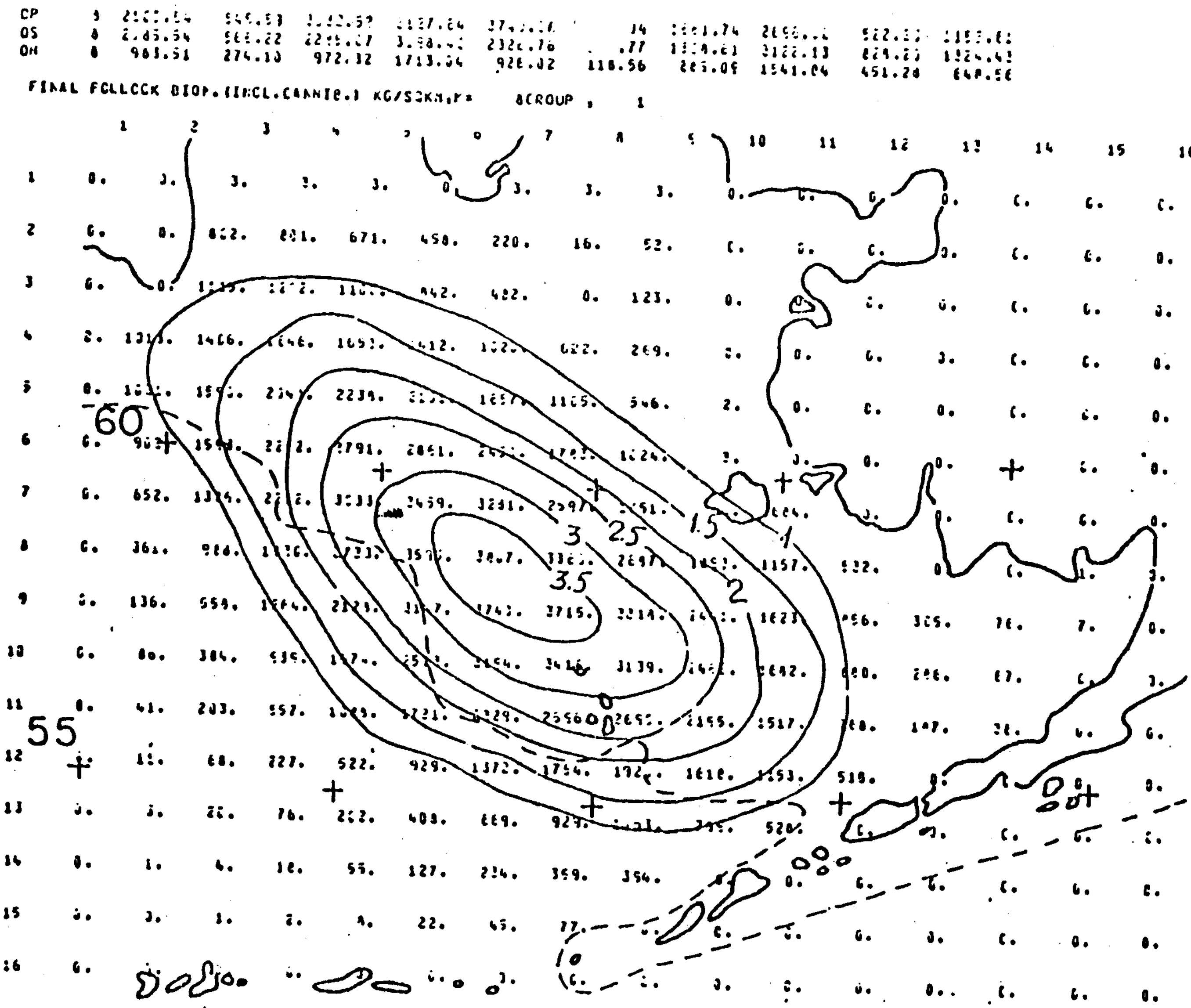

Figure 24 --Distribution of group 1 pollock (juvenile) in August, computed with DYNUMES II (isopleths in mt/km^2).

9.6 Current Status of Stocks

Stock assessment studies leading to determination of OY have been conducted on the following Bering Sea/Aleutians groundfish species categories:

- Alaska pollock
- Pacific halibut
- Yellowfin sole
- Turbots (arrowtooth flounder, Greenland turbot)
- Other flatfishes
- Pacific cod
- Rockfishes (primarily Pacific ocean perch)
- Sablefish
- Atka mackerel
- Squid
- Others

Results of those studies, including the determination of maximum sustainable yield, current equilibrium yield, and acceptable biological catch are contained in the Stock Assesment and Fishery Evaluation (SAFE), as described in Section 11.3.

The approach used in Bering Sea groundfish assessment is to (1) determine statistical trends that relate to stock condition and/or (2) apply applicable population dynamics theories and models to determine stock characteristics and their dynamics, and finally (3) assess the overall condition of the stock, often-times empirically, by taking into account statistical trends and population dynamics theories and models. The techniques used to analyze the data vary considerably from species to species depending on the quality and completeness of the availabile data bases. For each of the above species or species groups, the biological production potential, in terms of maximum sustainable yield (MSY), current equilibrium yield (EY), and acceptable biological catch (ABC), has been determined. The units for which these biological potentials have been derived are species or species groupings rather than the broader multiple species or ecosystem.

Maximum sustainable yield (MSY) is the largest average catch which can be taken from a stock over a period of years (in this case, generally since the development of significant fisheries in the 1960s) under the environmental conditions which persisted during that same period. This assumes an equilibrium in the population associated with a degree of stability in the environment during the time period considered. Even for such a relatively short time period neither the environment nor the dynamics of many fish populations can be expected to have been constant. The concept of MSY, therefore, is more applicable to longer-lived species in which variations in biomass are buffered by the presence of many year classes. Any long term stability in survival and recruitment, even in these populations is probably exceptional. As a general rule, therefore, MSY cannot be directly applied as a goal for fisheries management without proper evaluation of statistical trends in stock condition, such as can be inferred from current CPUE and age composition. In some instances, recent changes in environmental conditions may constrain current population growth to level far below historic levels of MSY. Under such circumstances the population would be at a lower level of equilibrium which may permit only a correspondingly low level of harvest, and even the most drastic of management measures may not restore a stock to some former level of productivity.

The present state of the science is inadequate to predict the capacity of environment for the production of fishery resources, ascertain with any certainty whether the depletion was a consequence of natural factors of overfishing, or to predict with confidence the consequences of remedial management action. The complicated interaction processes associated with the productivity marine fish populations in an ecosystem are not very well understood and even such fundamental assumptions as the association between stock size and recruitment strength, which are implicit in manipulation of harvest to achieve MSY, have not been verified or quantified. In fact, it is generally recognized by fisheries scientists that the existing theories and models pertaining to fishery resources management suffer some fundamental inadequacies, and concepts and theories must be developed to answer present and future management demands. Until such new concepts supercede the old, the latter can still serve as a useful basis for deriving management decisions, providing their limitations and underlying assumptions are recognized and evaluated with the best available information. This is the philosophy and approach used throughout this plan.

In contrast to MSY, equilibrium yield (EY) is based on the best estimates of the current condition of stocks. It is the annual or seasonal harvest which, theoretically, will maintain a stock at approximately the same level of abundance (apart from the effects of environmental variation) in succeeding seasons or years. In both under- and overexploited stocks, EY is less than MSY. When, on the basis of statistical trends, survey data, or other information, there is reason to believe that the abundance of stock is below that required to produce MSY, EY is then the maximum production that can be sustained under current population conditions. To rebuild such stocks to more productive levels, the annual or seasonal catch would have to be set below EY.

By definition, ABC is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitment. Operationally, ABC is the final, biologically-based estimate in the process leading to the determination of optimum yield (OY).

An important factor in determining ABC is an appraisal of the biological data base to evaluate its quality and completeness. If it is found lacking, a conservative approach to exploitation may be called for until evidence is produced to support a contention that higher yields can be sustained. In the absence of such evidence only catch levels which are equal to or less than the low end of the MSY-EY ranges can be considered relatively free from the risk of overexploitation. This concept acknowledges the possibility of overexploitation but, in the biological sense, overexploitation can lead to reduced abundance or undesirable ecosystem imbalance that might prevail for years while underexploitation leaves the resource base in a healthy condition, need only have a temporary effect on user groups, and, to some extent, the temporary loss to the users may be made up the following year.

In instances where a reasonably firm data base indicates that a stock is "healthy" in the context of current environmental and ecosystem conditions--i.e., is capable of producing the maximum equilibrium yield that then prevailing environmental conditions will allow--ABC may appropriately be set well into (rather than at the low end of) the current EY range, even though EY is believed to be lower than MSY. Similarly, next year's ABC may be set higher than this year's EY if higher than average recruitment is predicted (for instance, from prerecruit surveys).

9.7 Estimate of Future Stock Conditions

With the exception of Pacific ocean perch, Pacific halibut, and sablefish all other groundfish species in the Bering Sea/Aleutians region are believed to be at levels of abundance equal to or greater than those that would produce MSY. The management regime described in Section 14.0 is designed to keep those healthy stocks at or somewhat above the level of abundance required for MSY, while providing sufficient relief to halibut, ocean perch, and sablefish so that their stocks can rebuild.

With particular regard to halibut, winter trawl closures of the past several years (which are continued in this Plan) appear to have been responsible for reversing the downward trend in juvenile halibut abundance.

In addition, there is no evidence of natural phenomena that could be expected to cause either serious biological or socioeconomic consequences, although the possibility of undetected year class failures, declines in growth rate, or other adverse symptoms cannot be completely discounted. On the other hand, unforeseen enhancements of stocks condition are equally likely.

With the implementation of this plan, the short-term outlook for stock conditions is good.

In the context of long-term expectations, we are just now beginning to understand and quantify the complex relations among species and between the biota and the environment of this ecosystem (see Section 9.5). Until this understanding is much further developed, we are unable to predict the long-term effect on the ecosystem of the current, single species management strategies or of subtle environmental changes.

9.8 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 Bering Sea has certain characteristic features which make it different from other corresponding regions in higher latitudes (see Table 22 from Favorite and Laevastu, 1981). 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. Seasonal changes are more moderate than over the Bering Sea shelf. Ocean currents flow through the passes between the Islands, and south of the chain the narrow shelf is washed by a westward current which is stronger in the eastern part; on the Bering Sea side this current is missing.

The waters of the Bering Sea can be partitioned (Kinder and Schumacher, 1981 a,b) during the summer by transition zones which separate four hydrographic domains (Figure 25). 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 includes waters less than 50 m in depth that due to tidal mixing do not stratify seasonally. 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 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.

Net circulation in the Bering Sea is generally sluggish. However, moderate to strong tidal and wind-driven currents can be established over the shelf. 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 counter-clockwise 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

Table 22 CHARACTERISTIC FEATURES OF THE EASTERN BERING SEA SHELF ECOSYSTEM

Characteristic Features	Consequences
Physical Features	
Large continental shelf	High standing stocks of biota
	High fish production
	Large food resources for mammals
High latitude area	Nutrient replenishment with seasonal turnover
	Environmental distribution limits for many species
	Large seasonal changes
	Seasonal presence of ice
	Accumulation of generations
Large seasonal changes	Seasonally changing growth
	Seasonal migrations
	Possibility of large anomalies
Ice	Presence of ice-related mammals
	Migration of biota (in & out) caused by ice
	Limited production in winter
Cold bottom water	Outmigration of biota
	Higher mortalities & lower growth of benthic & demersal biota
	Accumulation of generations
High runoff	Low salinities (near coasts)
	High turbidities
	Presence of eurohaline fauna
Sluggish circulation	Local biological production
	Local pelagic spawning
Biological Features	
High production & slow turnover	High standing stocks
Fewer species (than in lower latitudes)	Few species quantitatively very dominant
High amounts of marine mammals & birds)	High predation by apex predators
Pronounced seasonal migrations	Great local space & time changes of abundance
Fisheries Resource Features	
Pollock dominate semidemersal species	Flexible feeding & breeding habits, especially environmental adaption
Yellowfin sole dominant demersal species	Abundant bethos food supply
Herring & capelin dominant pelagic species	Important forage species in the ecosystem
Abundant crab resources	Large, relatively shallow shelf
	Few predators on adults, especially environmental adaption
Abundant marine mammals	Abundant food supply, no enemies, insignificant hunting
	Competes with man on fishery resources
Man-related Features	
Fisheries development rather recent	Ecosystem in near-natural state, not yet fully adjusted to effects of extensive fishery
Little inhabited coasts	Ample space for breeding colonies for mammals & birds
	Very limited local fisheries, no pollution

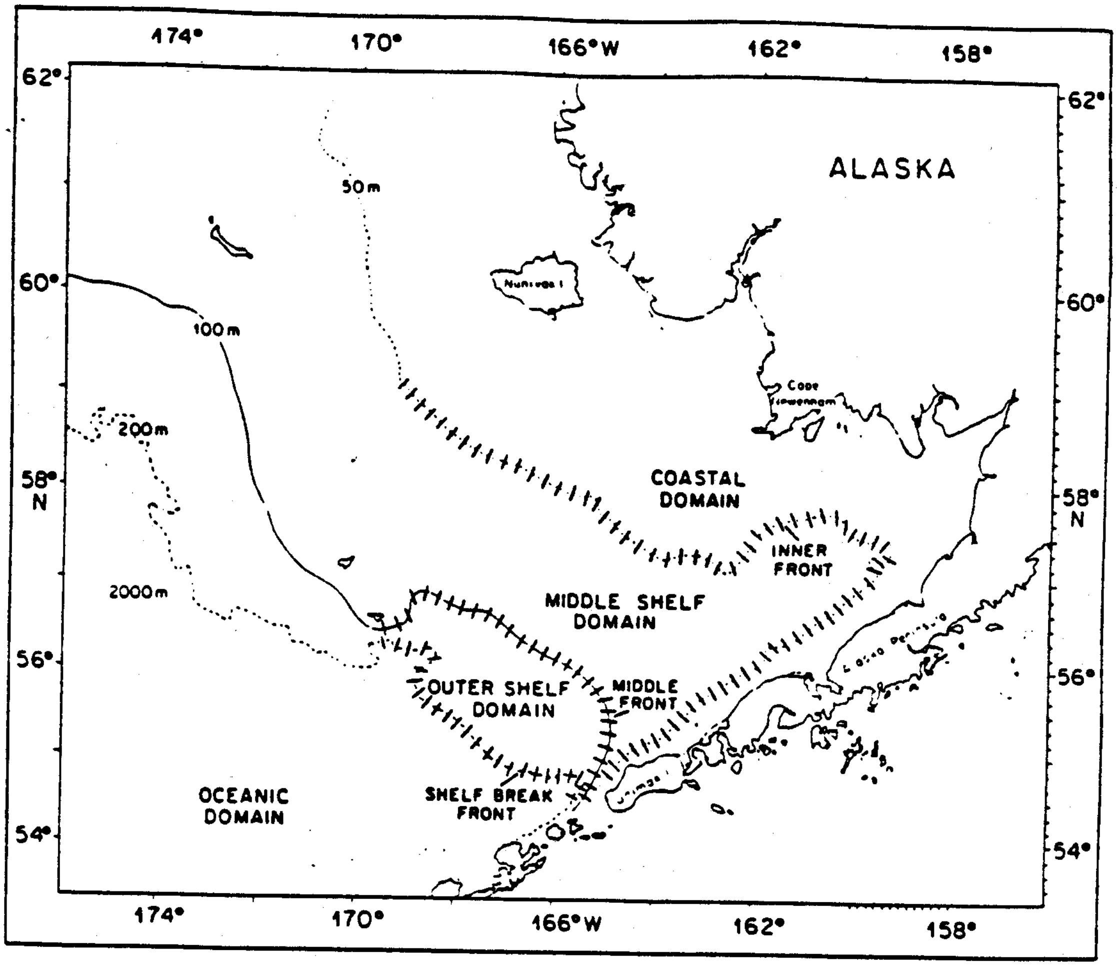

Figure 25. Hydrographic Domains And Transition Zones (Bars) During Summer In Bering Sea

shelf domain, a mean northwestward flow exists along the shelf edge and upper slope following depth contours.

With respect to the physiographic regimes and hydrographic domains of the Bering Sea, many species perform seasonal and spawning migrations from one domain to another. Shelf dwellers, such as yellowfin sole and Pacific halibut spawn in deep water 275-410 m (Garrison and Miller, 1982), while walleye pollock 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.

9.9 Habitat Areas of Particular Concern

With the possible exception of the ice-covered surface layer of the shelf during winter, there is not an area of the Bering Sea, water depth, or time of year when one or several species of commercial importance are not present at some life stage. It is difficult without better information 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 areas (among others) 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 dense spawning and feeding aggregations of yellowfin sole.

- Submarine canyons along the continental slope of the Bering Sea and Aleutian Islands harbor dense 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.

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 develop a finer definition of habitat areas of particular concern and a better ability to manage single and multispecies fishery resources.

10.0 OTHER CONSIDERATIONS WHICH MAY AFFECT THE FISHERY

10.1 International Pacific Halibut Commission (IPHC)

The fishery for Pacific halibut, a species that is part of this region's groundfish community, remains under the jurisdiction of IPHC and is, therefore, exempt from the provisions of this Plan. A major source of the fishing mortality on this species--that by incidental trawl catches--is, however, beyond IPHC control. As long as Council and IPHC objectives concerning halibut utilization remain identical, coordination between the two organizations is easily affected. Should halibut management philosophies diverge--for example, because the broader-based Council constituency objects to constraints on trawl fishery developed caused by overriding halibut-saving measures--a major social, political, and, perhaps, diplomatic (because of Canadian involved in IPHC and in the halibut fishery) confrontation could be precipitated. Furthermore, management actions taken in the Bering Sea that adversely affect halibut are likely to have a significant impact on the Gulf of Alaska halibut stock and fishery because of the interchange of halibut between the two regions.

10.2 Marine Mammal Protection Act of 1972

The FCMA of 1976 specifies that FMP's must be "consistent with...any other applicable law." The Marine Mammal Protection Act of 1972 is one that has a most serious impact on this FMP. There are large populations of many marine mammal species in the Bering Sea which are covered by the 1972 Act. The Act declares that marine mammals have "esthetic and recreational, as well as economic" value. To further these values, it provides that the "primary objective" of marine mammal management "should be to maintain the health and stability of the marine ecosystem." The Act further provides that "whenever consistent with this primary objective, it should be the goal to obtain an optimum sustainable population (of marine mammals) keeping in mind the optimum carrying capacity of the environment."

Pursuant to provisions of both Acts, this FMP is cognizant of the ecosystem and mammal population requirements. As reported in an earlier section on "Ecosystem Characteristics," a dynamic numerical marine ecosystem mode is currently in use to study ecosystem interactions, including those by marine mammals. The Plan Development Team of this FMP is acutely aware and is striving for an "ecosystem approach" for managing the marine resources. It will, however, be some time (3-5 years) before an appropriate ecosystem model has become far enough developed, and empirically tested, to begin to be relied upon for resource management. Until that time, single species models will be applied to the fishery resources, but in a manner that will retain balance among the various fish components, be generally conservative, and be determined to be not detrimental to current marine mammal populations. The manner in which MSY, EY, and ABC were derived for each fish stock in Annex I has indirectly taken into consideration the volume of fish needed by marine mammals for their sustenance. For example, natural mortality of fish stocks is taken into consideration in stock assessments and in its present application, includes the predation component by marine mammals.

Concerning marine mammal populations in the Bering Sea/Aleutians region, the Team has solicited expert advice from the Marine Mammal Division of the Northwest and Alaska Fisheries Center and summarized information on their distribution and migration, abundance and trends, feeding habits, and any problems induced by fisheries. Accounts of seven important species that are affected by the fisheries are given in Annex V. These species are the northern sea lion, northern fur seal, bearded seal, ringed seal, harbor seal, larga seal, and ribbon seal. Although specific ranges of optimum sustainable population has not been clearly determined for these species, the impact of fisheries can be inferred from marine mammal population trends. The Final Environmental Impact Statement on

Consideration of a Waiver of the Moratorium and Return of Management of Certain Marine Mammals to the State of Alaska (DOC and DOI, 1977) considered the population of six species, other than fur seals, to be at levels above the lower level of optimum sustainable population. Northern-fur seals are managed for maximum productivity and may also be at or above the lower level of optimum sustainable population.

Of the seven species, the seal lions and fur seals might be significantly affected by groundfish harvest levels. Although the northern sea lion population in Alaska has generally increased since the early 1900s and is now at a relatively high level, a 50% decline in seal lion population has been noted since the late 1950s in the eastern Aleutian Islands. The factors that may have caused this decline are not certain but probably include (1) a westward shift in distribution since population abundance to the western Aleutians appears to be high; (2) commercial fisheries interaction since groundfish (primarily pollock) forms a significant portion of their diet; (3) disease such as leptospirosis; and (4) other unknown population control factors. This decline in abundance is of concern and should be watched more closely. The proposed total groundfish OY for 1980 for the Aleutians region is below past catch levels and if the abundance of fish is limiting for sea lions in this region, this FMP should leave more fish for sea lion consumption.

The northern fur seal is the other species that may be significantly impacted by groundfish fisheries in that fur seals compete with Man for groundfish for their sustenance. Fishes are estimated to constitute about 80% of their diet and pollock is the only groundfish species covered by this FMP which forms a dominant portion of their diet. The average size pollock observed in fur seal stomachs is 20 cm indicating that the pollock utilized by fur seals have not yet been subjected to the commercial fishery which take pollock larger than 25 cm. The actual impact of diet on the fur seal population is, however, more intricate and has not yet been quantified. Based on population size trends which became stable during the period of highest fish harvest and the proposal that pollock catches remain below historical high levels, it appears that measures in this FMP should also leave more pollock for fur seal consumption. The ecosystem modelling studies have shown that the removal of larger sized pollock from the population may actually increase the abundance of juvenile pollock as effects of cannibalism is reduced.

The other five species of marine mammals do not seem to be adversely impacted by the groundfish fishery in that these mammals feed primarily on pelagic fish, cephalopods, benthos, and crustaceans. Four of these seal (bearded, ringed, harbor, and larga) populations are known to be high and stable. The ribbon seal population is believed to be relatively low, which has been attributed to commercial hunting by the Soviet sealing fleet. In recent years, this species has been afforded increased protection by Soviet sealing regulations and its numbers may be increasing again. Some groundfish eaten by ribbon seals but little direct competition is known to exist between ribbon seals and Man for fishery resources.

Although direct competition for food fish is one of many factors that affect marine mammal populations, the other factors are not readily quantifiable. Some of these mammals may be sensitive to distrubances created by fishing activities and may leave the area under such harassments. Harbor seals and ribbon seals are known to display such sensitivity, but it is difficult to quantify the effect of fishing on their behavior and abundance. It is noted that some harrassments take place, such as the use of explosives to scare away mammals during fishing operations. It is also important to note that the groundfish fishery covered by this FMP account for some marine mammal mortality by the fishing gear. Preliminary estimates of marine mammal incidental mortality due to foreign fishing vessels in 1978 (Marine Mammal Division, George Harry, pers. comm.) were 8.57 animals per 10,000 metric tons of groundfish by the Japanese fishing fleet, 1.69 by the Soviet fleet, and 9.84 in the Korean fleet.

Assuming an overall incidental mortality rate of 8.57 animals per 10,000 mt of groundfish, the total incidental mortality on marine mammals, most of which are expected to be northern (stellar) sea lions, is estimated to be 1,237 animals based on a total OY of 1,443,500 mt of groundfish proposed by this FMP.

Overall, the proposed groundfish FMP should reduce competition with marine mammals for fish when compared to the past decade. The proposed total groundfish OY is about 25 percent below the average catch of 1969-76, thereby leaving more fish for marine mammal consumption.

On the other hand, restrictions on killing or harassing seals and sea lions according to the Marine Mammal Protection Act results in an unknown but probably significant economic loss to the fishermen. First, in the setline fishery, some of these seals and sea lions mutilate or remove part of the catch before it can be taken aboard. Second, large numbers of the animals often gather around trawlers and attack halibut, salmon, and crabs which, as a conservation measure, are required to be returned to the sea. Third, and of greatest import, the maintenance of large populations of marine mammals--seals, sea lions, porpoises, and whales--has a profound impact on the abundance of commercial fish species. This impact is both direct, through predation on commercial species, and indirect, through grazing on the same food organisms utilized by commercial fish species.

The effect of such interaction is being studied by an ecosystem simulation model. In order to develop the model to encompass the ecosystem approach for managing the marine resources of the region, better information on the mammals and their interactions with other components of the ecosystem must be obtained. It will take time to refine and test this management for management purposes.

All fishermen, foreign and domestic, are required under the provisions of the Marine Mammal Protection Act of 1972 to obtain a marine mammal certificate of inclusion if any marine mammals might be taken incidental to the conduct of their fishing operation.

10.2.1 Endangered Species Act

The Federal action proposed in this fishery management plan is not likely to jeopardize the continued existence of endangered or threatened species, or result in the destruction or modification of habitat critical to those species.

10.3 Potential for Habitat Alteration

This section discusses types of human activities that have a potential to cause pollution and habitat degradation that could affect groundfish populations in the Bering Sea and Aleutian Islands area. It is not intended as a statement of present conditions; rather, it is designed to identify those areas of uncertainty that may reasonably deserve Council attention in the future. Whether the likelihood and level of these activities or events may cause harm to groundfish resources and their habitats can be better judged when the details of a proposed activity's location, magnitude, timing, and duration are more fully known.

Habitat alteration may lower both the quantity and quality of groundfish products through physical changes or chemical contamination of habitat. Species and individuals within species differ in their tolerance to effects of habitat alteration. It is possible for the timing of a major alteration event and the occurrence of a large concentration of living marine resources to coincide in a manner that may affect fishery stocks and their supporting habitats. The effects of such events may be masked by natural phenomena or may be delayed in becoming evident. However, the process of habitat degradation more characteristically begins with small-scale projects that result in only minor losses or temporary disruptions to organisms and habitat. As the number and rate of occurrence of these and other major projects increases, their cumulative and synergistic effects become apparent over larger areas. It is often difficult to separate the effects of habitat alteration from other factors such as fishing mortality, predation, and natural environmental fluctuations.

Species dependent on coastal areas during various stages of their life, particularly for reproduction, are more vulnerable to habitat alterations than are species that remain offshore. Also, the effects of habitat alteration on fish species offshore are not as apparent as they are in coastal areas. Concern is warranted, however, to the degree that (1) the offshore environment is subject to habitat degradation from either inshore activities or offshore uses, and (2) to the extent that some species living offshore depend directly or indirectly on coastal habitats for reproduction and food supply.

At present, there are no indications that human activities in the Bering Sea/Aleutian Island area have had any measurable effect on the existing habitats of groundfish, though there have been localized effects. The present primary human use of the offshore area is commercial fishing. While the establishment of other activities could potentially generate user conflicts, pollution, and habitat deterioration, it is the collective opinion of the Council and NMFS that the status of the habitat in this management area is generally unaffected by other human activities at this time.

10.3.1 Offshore petroleum production

More information can be found in 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 Thorsteinson (1982); and the University of Aberdeen (1978).

The Alaska offshore area comprises 74 percent of the total area of the U.S. continental shelf. Because of its size, the Alaska outer continental shelf (OCS) is divided into three 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.

If a commercial quantity of petroleum is found in the Bering Sea, its production would require construction of facilities and all the necessary infrastructure for pipelines to onshore storage and shipment terminals or for building offshore loading facilities. It is believed that Bering Sea oil would be pipelined to shore and then loaded on tankers for transportation from Alaska. In the Navarin Basin, however, offshore-loading terminals may be more feasible. Unlike exploration, production would continue year-round and would have to surmount the problems imposed by winter sea-ice in many areas. Norton Basin and perhaps Navarin Basin would require ice-breaking tanker capabilities. There are also occasional proposals for tankering oil from Arctic fields via the Bering Sea, which would also require ice-breaking capabilities.

Oil and gas related activities in the Bering Sea and Aleutian Island area have the potential to cause pollution of habitats, loss of resources, and use conflicts. Physical alterations in the quality and quantity of existing local habitats may occur because of the siting and construction of offshore drilling rigs and platforms, loading platforms, or pipelines.

Large oil spills are the most serious potential source of oil and gas development-related pollution in the eastern Bering Sea and Navarin Basin. Offshore oil and gas development will inevitably result in some oil entering the environment. Most spills are expected to be of small size, although there is a potential for large spills to occur. In large quantities, this oil can affect habitats and living marine resources. Many factors determine the degree of damage from a spill; the most important variables are the type of oil, size and duration of the spill, geographic location of the spill, and the season. Although oil is toxic to all marine organisms at high concentrations, certain species are more sensitive than others. In general, the early life stages (eggs and larvae) are most sensitive; juveniles are less sensitive, and adults least so (Rice et al., 1984).

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

It is possible for a major oil spill (i.e., 50,000 bbls) to produce a surface slick covering up to several hundred square kilometers of surface area. Oil would generally be at toxic levels to some organisms within this slick. Beneath and surrounding the surface slick, there would be some oil-contaminated waters. 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 affected by the loading of oil into contained areas of the nearshore environment. In the shallower waters, an oil spill could be mixed throughout the water column and contaminate the seabed sediments. Suspended sediment can also act to carry oil to the seabed.

Toxic fractions of oil mixed to depth and under the surface slick could 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 local and transitory, and would have only minor effects on fish populations overall. Measurable damage to fishery stocks from an oilspill would appear to be the exception rather than the rule. Even if concentrations of oil are sufficiently diluted not to be physically damaging to marine organisms or their consumers, it still could be detected by them, and alter certain of their behavior patterns. If an oil spill reaches nearshore areas with productive nursery grounds or areas containing high densities of fish eggs and larvae, a year class of a commercially important species of fish or shellfish could possibly be reduced, and any fishery dependent on it may be affected in later years. An oil spill at an especially important habitat (e.g., a gyre where larvae are concentrated) could also 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 dredged materials from pipeline laying or facilities construction. These materials might contain heavy metals or other chemical compounds that would be released to the environment, but the quantities are generally low and only local impacts would be expected to occur. Again, these activities may be of concern if they occurred in habitats of special biological importance to a resource.

10.3.2 Coastal development and filling

Minimal developmental pressure has occurred in the coastal habitat of the Bering Sea and Aleutian area. An extension of the airport runway at the village of Unalaska into water approximately 50-feet in depth has received the necessary permits but has not yet been constructed. Construction of a large-scale port facility is planned for the city of Nome and a smaller-scale harbor is currently under construction on St. Paul Island. Beyond these specific projects, development activity in the coastal areas of the Bering Sea and the Aleutian Islands has been largely limited to construction of erosion control measures and breakwaters (e.g., the city of Bethel). Because of the desirability of finding protection from Bering Sea storms, suitable port development sites often are valuable to fishery resources for similar related reasons. Without special considerations these facilities could affect local flushing, water temperatures, water quality, and access by fishes. In other areas, shallow water depth requires construction of long structures projected seaward in order to provide direct access from the uplands to deeper-draft ocean going vessels. These causeways could alter both along-shore physical processes and the migration and movement of fish in the area.

10.3.3 Marine mining

At present, mining activity has been limited to extraction of gravel and gold in the Bering Sea and the Aleutian peninsula. Gravel is needed for almost all construction projects throughout the area and is relatively unavailable from upland sources. Consequently, gravel is obtained by mining gravel beaches along the Bristol Bay coast (e.g., Goodnews Bay, Kangirlvar Bay) and in the lower reaches of the Yukon and Kuskokwim Rivers. Mining of large quantities of beach gravel can significantly affect the removal, transport, and deposition of sand and gravel along shore, both at the mining site and at other more distant areas. During mining, water turbidity increases and the resuspension of organic materials could affect less motile organisms (i.e., eggs and recently hatched fishes), and displace the more motile species from the area. Spawning and rearing habitats could be damaged or destroyed by these actions. Neither the future extent of this activity nor the effects of such mortality on the abundance of marine species is known.

Dredging for gold has been attempted at various sites along the Aleutians and there are several current proposals for the offshore mining of gold near the city of Nome. One such proposal, which has received all of the necessary permits to proceed, will entail dredging 21,000 acres of sea bottom in Norton Sound for the purpose of recovering gold. Such activity has the potential to cause physical damage directly and indirectly to benthic habitat and to fish during certain juvenile life stages.

10.3.4 Ocean discharge and dumping

At present, there are only two areas in the Bering Sea/Aleutian Islands area where the ocean discharge of materials is known to occur on a large scale. Both of the areas are dredged material disposal sites near the city of Nome and have been in use for approximately 50 years. Recently, the two areas were given final designation as ocean dredged material disposal sites by the Environmental Protection Agency. Use of these sites presents no new habitat concerns.

The return of materials dredged from the ocean to the water column is considered a discharge activity. Depending upon the chemical constituency of the local bottom sediments and any alterations of dredged materials prior to discharge, living marine resources in the area may be exposed to elevated levels of heavy metals. For example, natural deposits of mercury occur in eastern Norton Sound and elemental mercury, measured as reaching levels ranging from 250-1300 ug/l, has been identified in marine sediments in that area (Nelson et al., 1975). The levels of this heavy metal exceed the 3.7 ug/l set by the EPA Marine Quality Standards as the maximum allowable concentration; although no measurements of the more toxic methyl and dimethyl forms of mercury have been made in this area, Wood (1974) demonstrated that mercury available to the aquatic environment in any form can result in steady state concentrations of methyl, dimethyl, and metallic mercury through microbial catalysis and chemical equilibrium. Large-scale gold dredging projects proposed in eastern Norton Sound would result in the discharge and resuspension of sediments that could introduce mercury to the water column.

Accumulation of heavy metals in fish is usually natural, but also may be an indication of habitat deterioration. The Federal Drug Administration's (FDA) safety limit for mercury is presently 1.0 ppm of methyl mercury or about 1.1 ppm of mercury. In Hall, et al (1976) a sample of sablefish caught in the Bering Sea and in the vicinity of Kodiak Island contained levels of mercury (0.02 - 0.11, $\bar{x}$ 0.04 ppm)--well below the FDA limit. Levels found in the natural environment or the fish pose no problem at present.

10.3.5 Derelict fragments of fishing gear and general litter

The introduction of debris into the marine environment occurs when commercial fisheries take place. The debris includes netting, pots, longline gear, packing bands, and other material. Because of the lack of a monitoring program, estimates of debris have been based on 1) observations of debris at sea and on beaches, and 2) occasional reports of accidental or deliberate discards of fishing gear. Studies by Merrell (1984) and others have shown that much of the observed debris consists of fragments of trawl netting. Much of this netting may be discarded carelessly at the time nets are repaired.

The quantity of marine debris that is produced by commercial fisheries depends on a variety of factors including the types and amount of gear used and the efforts fishermen make to reduce both accidental and deliberate discards. It is not known how the type and amount of gear used will change or how such change will affect the level of debris.

Debris may result in the mortality of marine fish, marine mammals, and birds that become entangled in or ingest it. Discarded trawl netting that floats at the surface is not a threat to most fish, but it has been identified as a source of mortality for marine mammals and birds. Similarly, discarded packing bands have been identified as a source of mortality for marine mammals. Other discarded gear including pots continue to function unattended for varying lengths of time. Neither the extent of debris related mortality nor the effects of such mortality on the abundance of various species is known.

10.3.6 Benthic habitat damage by bottom gear

Bottom trawls are presently the predominant gear used for groundfish in the Bering Sea/Aleutian Island management area, and are likely to continue as the major gear for the flatfish and Pacific cod fisheries of the Bering Sea shelf. The generally flat and uniform bottom composed of sand and mud presents a good substrate for bottom trawling.

Any effect of gear dragged along the bottom depends on the type of gear, its rigging, and the type of bottom and its biota. In addition to the target species, movement of a bottom trawl through an area primarily affects the slow moving macrobenthic fauna such as seastars and sea urchins. Some bivalves can also be damaged. It is possible for demersal eggs such as rock sole and Pacific cod to be disturbed by the passage of trawls. Although little is known of the effects these disturbances and damages have on the affected species or their local communities, only minor impacts are suspected.

Numerous studies to determine these impacts have been conducted (notably in European waters) since World War II. Most of the studies and their results have been summarized in a report by Natural Resource Consultants (1984) titled "Trawl Evaluation Study". The consensus of these investigators is that the overall effect of trawling on sea bottom may not be harmful, and may in fact be beneficial. They found, for example: that trawl doors on sand and soft bottom stir up sand and silt which settle quickly. On muddy bottoms, the stirred up mud settles in a few hours, depending on the current speed and resulting turbulence near the bottom. Trawls have not been observed to kill flatfishes. The damaged organisms, as well as the infauna which might have been dug up by the trawl are quickly preyed upon by fish and crabs. Similar findings originate from a study of hydraulic clam dredges in the southeastern Bering Sea, where yellowfin sole quickly concentrated in the dredge wake feeding on exposed organisms. Several researchers observe that fishing by trawls with tickler chains has not resulted in any apparent effects on the sea bed or its biota (Hempel, 1979).

10.4 Bio-economic Factors

U.S. fishery interests have suggested that development of a domestic groundfish fishery in the Bering Sea will be based on the production of fillets and that the size of fish necessary to economically produce fillets is greater than that needed for such products as fish sausage and meal which form a large part of the output of the foreign fisheries.

The average size of pollock caught in the Bering Sea has decreased through the history of the fishery. During the early years (1964-69), the average size of fish taken by Japan varied between 42 and 44 cm (16.5 and 17.3 inches). Subsequently, average size decreased to 40 cm (15.7 inches) in 1972 and as low as 31 cm (12.2 inches) in 1975 before recovering to 33 cm (13 inches) in 1976. Current average size may be too small for efficient machine filleting.

The cohort analysis technique has been used to quantify the growth of a pollock year-class to is maximum biomass and subsequent decay as mortality overtakes growth. In theory, a year-class of pollock is subject to natural death (which reduces the number) and growth (which increases individual weight). The combined effect of these factors is that the cohort biomass will increase to a maximum and then decrease thereafter. Utilizing these concepts one can determine the age when a pollock cohort is maximized and what gain or loss in biomass from the theoretical maximum occurs from restructuring the population. In this analysis, species interactions are not taken into consideration; the analysis is concerned only with material change to the pollock population.

In order to explore the growth and decay phases of pollock cohort, the equation (Alverson & Carney, 1975) is used:

$$P_t = (N_o e^{-Mt}) W_{oo} (1-e^{-Kt})b$$

where P_t is the population weight at any specific time,

Noo is the beginning number of individuals, W_{oo} is the maximum weight at the maximum average theoretical size where Woo = aLb_{oo} (a = constant, Loo = maximum length, b = exponent),

M is the instantaneous natural mortality rate,
K is the Von Bertalanffy growth factor, and
t is time.

The sources of data used in the equation are as follows:

Von Bertalanffy growth parameters -- Yamaguchi and Takahashi (1972)

Male	Loo = 75.40	K = -0.165	to = 0.273
Female	Loo = 76.20	K = -0.163	to = 0.291

Length-weight relationship parameters

Male	a = 0.00952	b = 2.916
Female	a = 0.00820	b = 2.958

Other input parameters

No = 10,000 (any assumed number)
M = 0.43 (best estimate of M) (M = 0.35, 0.375, 0.4, 0.45, 0.5, 0.6 were also investigated)

ratio of male to female = 1:1

Results of the cohort analysis (Appendix II) show that a pollock cohort (both exes combined) maximizes its biomass at about age 4 (average size = 38 cm or 15 inches, average weight - 393 gm or 0.9 lbs) when M = 0.43. If that cohort is exploited at later ages, the exploitable biomass will decrease as follows:

Age	Biomass (% of maximum)	Average Length (inches)	Average Weight (lbs)
4	100	15.1	0.9
5	98	17.3	1.3
6	86	19.2	1.8
7	71	20.8	2.2
8	56	22.2	2.7
9	42	23.3	3.1
10	31	24.3	3.5

Exploitable biomass will, theoretically, decrease to about 50% of the maximum if average length is maintained at 22.2 inches (average age = 8; average weight = 2.7 pounds) instead of at 15 inches (the average length when yield is maximized).

Two other factors which appear to bear on this matter have been tentatively identified in a developing, numerical ecosystem model (Laevastu et al. 1976)1/. A major source of natural mortality within the pollock population is cannibalism. Therefore, maintanence of large numbers of large fish would result in a high rate of cannibalism of young which would, in turn, decrease recruitment and exploitable biomass, and ultimately lead to violent, self-generating cycles in total abundance and size structure of the population.

10.5 Crab-bait Trawl Fishery

The only domestic trawl fishery which occurs in the Bering Sea/Aleutians region at present is a relatively small effort for crab bait. This activity is pursued by a few crab vessels, using very small (as required by State of Alaska regulation) trawl nets and by 1-3 otter trawlers which sell their catches directly to crab vessels on the grounds. Total trawl catches for bait are estimated to have been about 450 mt in 1977 and 900 mt in 1978. Although a groundfish fishery, this trawl operation is more properly considered as an adjunct of the U.S. Bering Sea king and Tanner crab fishery. Because of this close relationship, the potential for gear conflicts--which is high when mobile (trawl) and fixed (crab pot) gear is used on the same grounds--is negligible in this unique situation.

1/ Laevastu, T., F. Favorite and B. McAlister. 1976. A dynamic numberical marine ecosystem model for evaluation of marine resources in eastern Bering Sea. Northwest & Alaska Fisheries Center, Natl. Mar. Fish. Serv. Processed report, 69 p.

11.0 OPTIMUM YIELD (OY) AND TOTAL ALLOWABLE CATCH (TAC)

11.1 Maximum Sustainable Yield (MSY) of the Groundfish Complex

The groundfish complex and its fishery are a distinct management unit of the Bering Sea. The complex has more than 10 commercially important species and many others of lesser or no commercial importance. This complex forms a large subsystem of the Bering Sea ecosystem with intricate interrelationships between predators and prey, between competitors, and between those species and their environment. Therefore, the productivity and MSY of groundfish should be conceived for the groundfish complex as a unit rather than for many individual species groups.

The MSY of the groundfish complex is the range of 1.7 to 2.4 million mt. This is calculated by summing the MSYs of each target species and of the "other species" category, as defined in Section 14.2.2 of this plan, that are derived from species-by-species analysis. A reasonable verification of the MSY for the groundfish complex is derived by averaging the 1968-1977 catches when the fishery went through periods of growth, peak, decline, and some stability (see Section 5.2 on History of Exploitation). The average catch was 1.8 million mt with a range of 1.1 to 2.4 million mt.

An ecosystem model of the Bering Sea developed by the Northwest and Alaska Fisheries Center (Laevastu and Larkins, 1981) shows that the mean exploitable biomass for the groundfish species covered by this FMP is about 9.3 million mt. This ecosystem model, the Prognostic Bulk Biomass (PROBUB) model, simulated the principal components of the ecosystem (mammals, birds, demersal fish, semi-demersal fish, pelagic fish, squid, crabs, and benthos) and considered their fluctuations in abundance caused by predation, natural mortality, environmental anomalies, and fishing. The magnitude of the mean exploitable biomass (9.3 million mt) suggests that the annual yield from it is probably much higher than the 1.7 to 2.4 million mt range estimated conservatively by the single species approach.

The ecosystem consideration also indicates that MSY of the groundfish complex may change if the present mix of species is altered substantially from the present period. Therefore, as changes take place, MSY for the complex may have to be reexamined.

11.2 Optimum Yield of the Groundfish Complex

The optimum yield (OY) of the groundfish complex is set equal to 85% of the MSY for the target species and the "other species" categories (1.4 to 2.0 million mt) to the extent this can be harvested consistently with the management measures specified in this FMP plus the actual amount of the nonspecified species category that is taken incidentally to the harvest of target species and the "other species" category. This deviation from MSY reflects the combined influence of biological and socioeconomic factors. The important biological factors indicate that:

1. When considering condition of individual species within the complex, the OY range encompasses the summed Acceptable Biological Catches (ABC) of individual species for 1978-1981 (Low, et al. 1978; and Bakkala, et al. 1979, 1980, and 1981). This sum may be used as an indicator of the biological productivity of the complex, although it is not completely satisfactory, because multi-species/ecosystem interactions cannot be adequately taken into account. The 15% reduction of MSY reduces the risk associated with relying upon incomplete data and questionable assumptions in assessment models used to determine the condition of stocks.

2. When considering multi-species/ecosystem models, the OY range is probably a conservatively safe level for the groundfish complex. The mean exploitable biomass of 9.3 million mt for the species groups (Laevastu and Larkins, 1981) suggests that the harvest level can be considerably higher than the OY range.

Although the multi-species/ecosystem models suggest that the harvest level can be higher than 2.0 million mt, it would only be so if the proper combination of exploitation rates by individual species commensurate to the natural balance of the groundfish complex is applied. This combination may not be desirable to the fishermen because the industry prefers only certain species. The recent catch history indicates that the present mix of species is socio-economically acceptable and that the groundfish complex should probably not be exploited at levels higher than 2.0 million mt at this time.

All of the socioeconomic considerations indicate that:

1. The OY range is not likely to have any significant detrimental impact on the industry. On the contrary, this range, when compared to the annual determination of OY, is more desirable because it creates a more stable management environment where the industry can consistently plan its activities with a minimum expectation of OY being equal to 1.4 million metric tons.

2. The OY range also covers actual catch levels during 1974-76 when the foreign fishery operated profitably before the MFCMA was implemented and is slightly higher than actual catches since then. It will allow the foreign fishery to operate near historic levels and yet offer considerable opportunities for domestic fishery expansion.

Therefore, the range of 1.4 to 2.0 million mt of the target species and "other species" categories, to the extent it can be harvested consistently with the management measures prescribed in this FMP, plus the incidental harvest of nonspecified species, will be the OY of the Bering Sea/Aleutian Islands groundfish complex covered by this FMP unless the plan is amended. An amendment will be made when the status of the groundfish complex changes substantially from the present condition or when socioeconomic considerations dictate that OY should fall outside the present range. OY may also have to be reexamined if substantial change from the present mix of species occurs or is desired of the groundfish complex.

11.3 Total Allowable Catch (TAC)

The Secretary, after receiving recommendations from the Council, will determine TACs and apportionments thereof among DAP, JVP, TALFF, and reserves for each target species and the "other species" category by January 1 of the new fishing year, or as soon as practicable thereafter , by means of regulations implementing the FMP. The Secretary will implement one-fourth of the preliminary TACs and apportionments thereof on or about January 1 of each year on an interim basis. They will be replaced by final TACs as approved by the Secretary following the Council December meeting.

Notwithstanding designated target species and species groups listed in Section 14.2B.2 on page 14-1, the Council may consider whether splitting or combining species in the target species category for purposes of establishing new TACs is desirable based on commercial importance of a species or species group and whether sufficient biological information is available to manage a species or species group on its own biological merits.

Prior to making recommendations to the Secretary, the Council will make available to the public for comment as soon as practicable after its September meeting, a preliminary Stock Assessment and Fishery Evaluation (SAFE) and preliminary specifications of ABC and TAC for each target species and the "other species" category, and apportionments thereof among DAP, JVP, TALFF, and reserves. At a minimum the SAFE will contain information listed in Section 11.3.1.

At its December meeting, the Council will review the final SAFE and comments received. The Council will then make final recommendations to the Secretary.

11.3.1 The Stock Assessment and Fishery Evaluation

For purposes of supplying scientific information to the Council for use in utilizing the above procedure, a The Stock Assessment and Fishery Evaluation (SAFE) is prepared annually. The SAFE will, at a minimum, contain or refer to the following:

(1) Current status of Bering Sea and Aleutian Islands area groundfish resources, by major species or species group.
(2) Estimates of maximum sustainable yield (MSY) and acceptable biological catch (ABC).
(3) Estimates of groundfish species mortality from nongroundfish fisheries, subsistence fisheries, and recreational fisheries, and difference between groundfish mortality and catch, if possible.
(4) Fishery statistics (landings and value) for the current year.
(5) The projected responses of stocks and fisheries to alternative levels of fishing mortality.
(6) Any relevant information relating to changes in groundfish markets.
(7) Information to be used by the Council in establishing prohibited species catch limits (PSCs) for prohibited species and fully utilized species with supporting justification and rationale.
(8) Any other biological, social, or economic information which may be useful to the Council.

When the TACs for the complex and species groups are determined, Domestic Annual Harvest (DAH) and Total Allowable Level of Foreign Fishing (TALFF) are updated in accordance with Section 11.4 and Annex II.

11.3.2 Reserves

The groundfish reserve at the beginning of each fishing year shall equal the sum of 15% of each target species and the "other species" category TAC. When the TAC for the groundfish complex is determined by the Council, 15% of the TAC is set aside as a reserve. This reserve is used for: (a) unexpected expansion of the domestic fishery, (b) correction of operational problems of the domestic and foreign fishing fleets, promoting full and efficient use of groundfish resources, (c) adjustments of species TACs according to the condition of stocks during the fishing year, and (d) apportionments.

The reserve is not designated by species or species groups and will be apportioned to the fishery during the fishing year by the Regional Director in amounts and by species that he determines to be appropriate. The apportionment of the reserve to target species or to the "other species" category must be consistent with the most recent assessments of resource conditions unless the Regional Director finds that the socioeconomic considerations listed above or specified fishery operational problems dictate otherwise. Except as provided for in the National Standard Guidelines for Fishery Conservation and Management, the Regional Director must also find that the apportionment of reserves will not result in overfishing as defined in the guidelines. The Regional Director may withhold reserves for conservation reasons.

11.3.3 Apportionments to Fishery

When the TAC for each target species and the "other species" category is determined, it is reduced by 15% to form the reserve, as described above. The remaining 85% of each TAC is then apportioned to DAP, JVP, and TALFF (in that order) by the Regional Director as described in Section 11.4.

11.4 Derivation of DAH and TALFF Amounts

Amounts of DAH (= DAP + JVP) for each species or species group established for the beginning of the fishing year shall equal the amount of those species harvested by domestic fishermen during the previous year plus any additional amounts the Regional Director projects to be necessary to satisfy the needs of the growing domestic fishery during the coming year. These supplemental amounts will be based on projected increases in U.S. harvesting and processing during the coming year. In making these projections, the Regional Director shall rely upon the latest available information, including industry surveys and market data, that he finds to be sound. The initial TALFF amounts for each target species and the "other species" category will be established from the following equation: TALFF = TAC - (DAH + Reserve) (see Table 22a for an example). The TALFF for the "nonspecified species" category is the amount of that category caught incidentally to the harvest of target species and the "other species" category. The Regional Director shall make proposed DAP, JVP and TALFF figures available for public comment, along with recommended TACs as stated in Section 11.3 above.

11.5 Reapportionments of Reserve and Unneeded DAP and JVP

The Regional Director may assess the DAP and JVP at any time and apportion to them any amounts from the reserve that he finds will be taken by U.S. vessels. As the fishing season progresses, should the initial DAP exceed subsequent expectations of actual harvest, the Regional Director shall reapportion the excess to JVP, if needed, or to TALFF.

If the initial JVP exceeds subsequent expectations of actual harvest, the Regional Director shall reapportion the excess to DAP, if needed, or to TALFF. The Regional Director shall apportion to TALFF as soon as practicable after April 1, June 1, and August 1, and on such other dates as he determines appropriate any portion of the reserve, JVP and/or DAP that he determines will not be harvested by U.S. fishing vessels during the remainder of the fishing year.

When the Regional Director determines that apportionment is required on dates other than those scheduled or that immediate action is necessary to increase DAP, JVP, or TALFF, he may decide that such an adjustment is to be made without affording a prior opportunity for public comment. Public comments on the necessity for, and the extent of the apportionment shall then be submitted to the Regional Director for a number of days after the effective date that will be specified in a notice announcing such action.

Table 22a. An example of the Total Allowable Catch (TAC), Domestic Annual Harvest (DAH) and Total Allowable Level of Foreign Fishing (TALFF) (metric tons)

Species Group	Areas 1/	Example TAC 2/ 3/	Reserve 4/	Initial DAH 5/	Initial TALFF 5/
Target Species Category					
Pollock	I+II+III	1,200,000	180,000	74,500	945,500
	IV	100,000	15,000	-0-	85,000
Pacific Ocean Perch	I+II+III	1,000	150	850	-0-
	IV	2,600	390	1,380	830
Other Rockfish	I+II+III	11,000	1,650	775	8,575
	IV	11,000	1,650	775	8,575
Sablefish	I+II+III	2,000	300	700	1,000
	IV	900	135	700	65
Pacific Cod		168,000	25,200	43,265	99,535
Yellowfin Sole		214,500	32,175	31,200	151,125
Turbots		76,500	11,475	1,075	63,950
Other Flatfish		92,500	13,875	11,200	67,425
Atka Mackerel		24,800	3,720	14,500	6,580
Squid		10,000	1,500	50	8,450
"Other Species" Category		55,300	8,295	7,800	39,205
TOTAL		1,970,100	295,515	188,770	1,485,815

1/ Fishing areas of the Bering Sea/Aleutian region, unless stated otherwise. See Figure 26a for map.

2/ From Section 11.3. Figures are examples, based on the 1981 single species ABCs. See Bakkala, et al., 1981.

3/ The TAC for the "nonspecified species" category equals the amount of that category caught during the fishing year in the course of harvesting the TACs for the target species and "other species" categories.

4/ Reserves are 15% of the TACs.

5/ To be determined, figures are examples only.

11.6 Seasonal Apportionment of Pollock JVP[1/]

The annual apportionment of pollock to JVP in the Bering Sea and Aleutian Islands will be released in two parts during the fishing years 1988 and 1989. Part One will be equivalent to 40 percent of the following sum: initial JVP plus 15 percent of the TAC for pollock. Part One will apply to the period January 15 through April 15. Part Two will be equivalent to the remaining pollock JVP. Part Two will apply to the period April 16 through December 31.

11.7 Prohibited Species Catch Limits for Fully Utilized Groundfish Species

The timing of actions and procedure to be taken in establishing prohibited species catch limits (PSCs) of fully utilized groundfish species are as follows:

(1) September. Following the initial determination of TACs for all managed groundfish species as described in Section 11.3, the plan team will identify those groundfish species that are fully utilized by the domestic fishery. For those species, initial PSC limits will be calculated for joint venture and foreign fisheries using the best available bycatch rates obtained by NMFS observers from the respective fisheries and applying them to initial joint venture (JVP) and foreign (TALFF) TAC apportionments.

(2) September Council meeting. Council will review and approve preliminary PSCs and release the SAFE for 30-day public review.

(3) October 1. As soon as practicable after October 1 the Secretary, after consultation with the Council, will publish a notice in the Federal Register specifying the proposed PSCs for JVP and TALFF. Public comments on the proposed PSCs will be accepted by the Secretary for 30 days after the notice is published.

(4) November. Plan Team prepares final SAFE.

(5) December Council meeting. Council reviews public comments, takes public testimony and makes final decisions on annul PSC limits.

(6) By January 1 the Secretary will publish a notice of final PSC limits in the Federal Register.

(7) January 1. Annual PSC limits take effect for the current fishing year.

1/ Example of seasonal pollock JVP apportionment:

Assume Pollock TAC equal to	1,000,000 mt
Subtract a 15% "reserve"	150,000 mt
	850,000 mt.
Assume DAP apportionment of	350,000 mt
	500,000 mt initial JVP

(Initial JVP + "reserve") x 0.40 equals Part One

(500,000 + 150,000) x 0.40 = 260,000 mt Part One

260,000 mt minus allowances for pollock bycatch equals JVP pollock target for January 15 through April 15. If additional bycatch during the first period is necessary it will be counted against Part Two.

12.0 CATCH AND CAPACITY DESCRIPTORS

12.1 Domestic Annual Capacity

12.1.1 Domestic Commercial Processing Characteristics

Since the domestic groundfish fishery in the Bering Sea and Aleutians consists of a part time trawl operation for king and Tanner crab bait, and a few weeks of longlining for halibut each year, there essentially is no industry to describe. The information presented is more of a description of the latent groundfish capacity of the current shellfish industry including some expansion plans.

A survey was made of the majority of the companies which process shellfish in the eastern Aleutian Islands (Unalaska and Akutan) and the western end of the Alaska Peninsula. The central and northeastern Alaska Peninsula and Bristol Bay plants, except as they might represent investment and contribute to gross sales of the parent companies with operations further west, were not considered because of their inability to be operated year round either because of ice or specialization for summer salmon processing.

Representatives of ten companies with sixteen operations in the Aleutians and western Alaska Peninsula were contacted. Responses to all questions were not obtained due to the tentative nature and lack of completeness of plans for groundfish operations in 1979, or because company policy precluded divulging certain information.

Seven of the companies with operations in the area indicate gross annual sales of a total of 192.5 million dollars. This amounts to 43% of the total first wholesale value of all fisheries products processed in Alaska in 1976, the latest year for which data are available.

Since several of Alaska's major processing companies are represented in the relatively small number of companies with operations in the area, an average gross expanded to include all operators is not included in this section because it would likely provide an inflated representation of the size of the marketing structure of the westward processors.

Of the fifteen companies known to have operations in the western Alaska Peninsula-Aleutian Islands, nine indicated current plant investments totalling 61.5 million dollars. As in the case of total sales, this is considered a typical since almost all the major companies operating in Alaska are represented in the sample.

It should be noted however, that the companies with operations in the area are heavily involved in the fish processing business in Alaska through plant investment, and account for a substantial portion of the resources processed in the state.

The processing industry in westward Alaska is highly dependent upon transient labor. The small villages of Unalaska and Akutan have inadequate workforces to handle the catches of the large, modern Bering Sea crab fleet. In the early period of the fishery, workers from the Pribilof Islands and the coastal Eskimo villages were recruited for processing work. While the industry still depends on Alaskan help to a considerable extent, the expansion of processing capacity as a result of the growing Tanner crab fishery and the displacement of the Japanese and Russian king crab fisheries in the Bering Sea have necessitated increased recruitment from the other states.

One of the problems processors have had to cope with is processing the crabs, especially king crab, fast enough to get the catcher boats turned around and back to the fishing grounds. As the fleet grows in size and efficiency, the processor is faced with a shorter season in which to get enough product to make a profit, while keeping the "turn-around" time for the vessels delivering crab short so that the skippers do not find it in their best interest to seek markets elsewhere.

The solution to these particular problems has been to create a large transient work force and the facilities to house it. Shoreside and shipboard bunkhouse facilities in the eastern Aleutians currently have the capacity to house approximately 2,400 workers.

To the extent that the current and planned capacity would be suitable for groundfish, the daily freezing and holding capacity has been used as an indication of the domestic processor's groundfish capacity.

Plans for 1979 include some processing capacity at Unalaska which will be dedicated entirely to groundfish. There are indications that such plans are being considered, by several companies, but target dates are indefinite. Several of the company representatives interviewed believed that groundfish and crab operations are not compatible, i.e., groundfish cannot be processed in a vacant corner of a crab plant, nor can crab processing lines be torn out or modified for short periods of time to convert a plant to finfish processing. The consensus seemed to be that if there were to be a serious attempt to process groundfish on a production basis, the plant would have to be planned and built from the ground up in order to provide for the efficiency necessary to profit from a high volume-low priced product. None of the shellfish processors indicated that groundfish could be handled while the crab season is open, for reasons discussed above.

Estimates of freezing and holding capacities, and the percentage of time a plant would be available for processing groundfish were obtained from seven companies involving eleven operators. Estimates of from 20% to 50% were made of the plants' annual capacity that would be available for diversification.

The seven companies represent a cumulative daily freezing capacity of 520 mt. This capacity would be available 37% of the year, on the average. Therefore, if it is assumed, as it was for the Gulf of Alaska groundfish fishery, that a processing plant can operate 250 days a year, then

$$520 \text{ mt} \times .37 \times 250 = 48{,}100 \text{ mt}$$

would represent the estimateannual capacity of the processors in the area during the crab off-season. Since there is some question as to the ability to process and freeze groundfish during crab seasons, no attempt has been made to estimate capacity during those periods of time.

In addition to the estimated off-season capacity in the shellfish fishery, there are plans to have 6,250 mt of capacity exclusively designed for groundfish. Total estimated capacity would then be 54,350 mt.

Nine processors indicated a cumulative holding capacity of 13,900 mt. This would hold about a twenty day run of the off-season freezing capacity in the area.

12.1.2 Commercial Fishing Fleet

A projection of domestic annual capacity for groundfish in the Bering Sea is limited by the fact that to date there has been virtually no effort directed at the harvesting of groundfish in the Bering Sea by U.S. fishermen. Since a domestic trawl fishery has yet to be developed, an estimate of domestic capacity must rely upon a determination of the types of existing vessels that are likely to succeed in the fishery and how much fishing time will be available to them.

NORFISH, a Sea Grant program at the University of Washington, has been involved in an analysis of the shellfish fleet in the state of Alaska, with reference to the future development of a domestic trawl fishery. A classification system was developed for characterizing shellfish vessels on the basis of such characteristics as length, horsepower, hull type and gear types employed 1/. Certain types of shellfish vessels are likely candidates for entry into a trawl fishery, based on their trawling capability and other features. In particular, combination crabber-trawler type vessels (classes 8.1 to 8.5) have the largest potential fishing power of the existing shellfish vessels for the harvesting of groundfish. Subsequent estimates of capacity are based on these vessel classes, since they are expected to provide most of the initial future capacity.

An initial estimate of domestic harvest capacity can be obtained by examining the hold capacity of the combination vessels, shown in Table 23. This estimate assumes a packing factor of 40 pounds of iced fish per cubic foot of space. Also included are the number of vessels in each class which have made shrimp landings and provide a minimum estimate of the number of combination vessels currently equipped to trawl. Table 24 indicates the change in number of combination vessels between 1975 and 1977. The net increase in number of combination vessels has resulted in an overall increase in total hold capacity of 10% over the past two years.

Another factor affecting capacity is the amount of fishing time available. If it can be assumed that the domestic trawl fishery will begin primarily as an off-season fishery for shellfish fishermen, currently unused fishing time within the fleet would provide an estimate of time available for harvest of groundfish. To determine if there is unused capacity within the combination vessel classes, an analysis of the landing record of each vessel was performed. 2/ The frequency distribution of interlanding times was used to derive an estimate of maximum trip length for each species fished. The maximum trip length was adjusted to take into consideration the limitation of holding time on board for various species. Allowing for a layup of 60 days per vessel, the number of additional fishing trips available by vessel class and trip length were calculated.

Given the current limitations in holding catches on board, particularly in the case of pollock, a 4- to 7-day trip length seems reasonable to expect. If 20-30 mt per day is a realistic catch rate in the Bering Sea, then the domestic annual capacity could be expected to be about 157,000 mt. This estimate was calculated by ignoring 1- to 3-day intervals and adding in the appropriate number of 4- to 7-day trips which could be made from within the longer time intervals.

1/ NORFISH Technical Report #61. The Classification, Enumeration, Characteristics and Economic Performance of Alaskan Fishing Vessels, NEPAC Progress Report II. 1976. 23 pp.

2/ Methods used are detailed in NORFISH Paper NPB3, Pragmatic Approaches to Fisheries Management for Optimum Yield -- Determination of Supply Curve for a Domestic Alaska Pollock Fishery , 1977, 7 pp; and in Technical Report #79 (In prep.).

Table 23. Hold Capacity of Combination Crabber-Travwler Vessels.

NORFISH Class	No. of registered vessels	Keel length (feet)	Ave. hold capacity (cu.ft.)1/	Total capacity (40lbs/cu.ft.)	Class total (lbs.)	Number to trawl shrimp
8.1	30	50.1-70.	2800	112,000	3,360,000	11
8.2	65	70.1-82.	3000	120,000	7,800,000	24
8.3	38	82.1-90.	3500	140,000	5,320,000	8
8.4	32	90.1-100.	5500	220,000	7,040,000	1
8.5	14	100.1-100.	7500	300,000	4,200,000	0
	179				27,720,000 (or 12,375 mt)	

1/ Revised figures provided from shellfish research group sessions held by Alaska Commercial Fisheries Entry Commission, 1977.

Table 24. Changes in Number of Registered Shellfish Vessels, Western Alaska, 1975-1977.

Class	No. registered 1975	No. boats gained	No. boats lost	Net gain	No. registered 1977	No. registered 1/ SE AK 1977
8.1	25	5	1	4	29	1
8.2	65	9	10	-1	64	1
8.3	31	4	0	4	35	3
8.4	28	4	0	4	32	0
8.5	13	3	2	1	14	0

1/ Southeast Alaska vessels were tabulated seperately since the 1975 survey did not include them.

It should be noted that this estimate of domestic annual capacity assumes that all combination vessels are currently equipped to trawl. In fact, perhaps half of the fleet would require extensive modification beforehand. This figure is also high considering unused effort that might be directed towards Gulf of Alaska groundfish fisheries instead of the Bering Sea. Conversely, if trawling for groundfish in the Bering Sea proves to be more profitable than participating in alternative fisheries, the estimate of domestic annual capacity would need to be adjusted upward.

12.2 Expected Domestic Annual Harvest (DAH)

Expected domestic annual harvest (DAH) is the estimated portion of the U.S. groundfish harvest which will be utilized by domestic processors (DAP), which includes those amounts of groundfish "processed" for use as bait or for personal consumption, and the estimated portion, if any, delivered to foreign processors (JVP) which are permitted to receive U.S. harvested groundfish in the Fishery Conservation Zone and internal waters.

The estimate of DAP will be updated annually based upon the previous year's production and projected increases in U.S. processing. JVP is the U.S. harvested portion of the OY in excess of the estimated amount to be utilized by U.S. processors or for which actual domestic markets are not available, that will be delivered to foreign processors who are authorized to receive such U.S. harvested fish in the Fishery Conservation Zone and internal waters. Estimates of utilization in this category are updated annually based upon the previous year's catch and projected increases in catch anticipated by the various joint venture companies.

Estimates of future production by processors are difficult, if not impossible, to make accurately. It is generally recognized by those processors making the estimates that their figures are optimal and based on assumptions that sometimes do not materialize. Machinery or installation delays, changes in markets, better than normal alternative fisheries for the fishing fleets (or processors) may all affect their actual production. Therefore, a DAH reassessment system and release mechanism is established through this plan and by regulation to allow adjustments in DAH during the plan year.

Production by U.S. fishermen and processors shall be reassessed periodically based on:

1. catch and production to date during the year;
2. current fishing and production activity; and
3. projections for additional catch and production during the remainder of the year based on demonstrated capacity.

Releases from DAH to TALFF shall be made by the NMFS Regional Director as described in Section 11.5. No release or transfer shall be made if such release is likely to have a significant adverse biological, economic, or social consequence.

13.0 ALLOCATIONS BETWEEN FOREIGN AND DOMESTIC FISHERMEN

13.1 Reserve

U.S. participation in the fishery in the near future is expected to consist of a relatively modest catch for crab bait, a growing Pacific cod fishery, expanding joint ventures for yellowfin sole, pollock, and Atka mackerel and limited efforts for other bottomfish production.

In order to prevent the TAC established for the target species and "other species" categories from being exceeded without preventing unexpected domestic fishery development; i.e., an unanticipated increase in U.S. catching or processing, 15% of the TAC established for these categories will be held in reserve, as described in Section 11.3.1.

The reverse will be released by the Regional Director in accordance with Section 11.5.

13.2 Total Allowable Level of Foreign Fishing (TALFF)

The initial TALFF for each species shall be determined by the equation: Initial TALFF = TAC - (DAH + Reserves).

The final TALFF for each target species and for the "other species" category shall be determined as the fishery progresses and may be increased over the initial TALFF as described in Section 11.5.

The procedure for deriving initial DAH and TALFF is prescribed in Section 11.4.

All allocations to TALFF are subject to the management measures prescribed in this FMP, including, in the case of TALFF, prohibited species catch restrictions.

14.0 MANAGEMENT REGIME

14.1 Management Objectives

Five priority objectives dictate the philosophy of management for the groundfish fishery in the region:

(1) Provide for rational and optimal use, in a biological and socioeconomic sense, of the region's fishery resources as a whole;
(2) Minimize the impact of groundfish fisheries on prohibited species and continue the rebuilding of the Pacific halibut resource;
(3) Provide for the opportunity and orderly development of domestic groundfish fisheries, consistent with (1) and (2) above; and
(4) Provide for foreign participation in the groundfish fishery, consistent with all three objectives above, to take the portion of the TAC not utilized by domestic fishermen.
(5) Seek to maintain the productive capacity of the habitat required to support the Bering Sea/Aleutian Islands groundfish fishery.

14.2 Area, Fisheries, and Stocks Involved

This Fishery Management Plan and its management regime governs:

A. Fishing by foreign and United States vessels in the U.S. Fishery Conservation Zone of that portion of the North Pacific Ocean adjacent to the Aleutian Islands which is west of 170°W up to the U.S.-Russian Convention Line of 1867, and of the Eastern Bering Sea (See Figure 26).

The FMP area is divided into four fishing areas as shown in Figure 26a and described in Appendix III.

B. All stocks of finfish and marine invertebrates except salmonids, shrimps, scallops, snails, king crab, Tanner crab, Dungeness crab, corals, surf clams, horsehair crab, lyre crab, Pacific halibut, and Pacific herring which are distributed or are exploited in the area described in 4.2.A, above.

Four categories of species or species groups are likely to be taken in the groundfish fishery. The optimum yield concept is applied to all except the "prohibited species" category. These categories are tabulated in Annex V and are described as follows:

1. Prohibited species -- are those species and species groups the catch of which must be returned to the sea with a minimum of injury except when their retention is authorized by other applicable law. Foreign fisheries must maintain catch records. Groundfish species and species groups under this FMP for which the quotas have been achieved shall be treated in the same manner as prohibited species.

2. Target species -- are those species which are commercially important and for which a sufficient data base exists that allows each to be managed on its own biological merits. Accordingly, a specific TAC is established annually for each target species. Catch of each species must be recorded and reported. This category includes pollock, Pacific cod, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, "other flatfish," sablefish, Pacific ocean perch, "other rockfish," Atka mackerel, and squid.

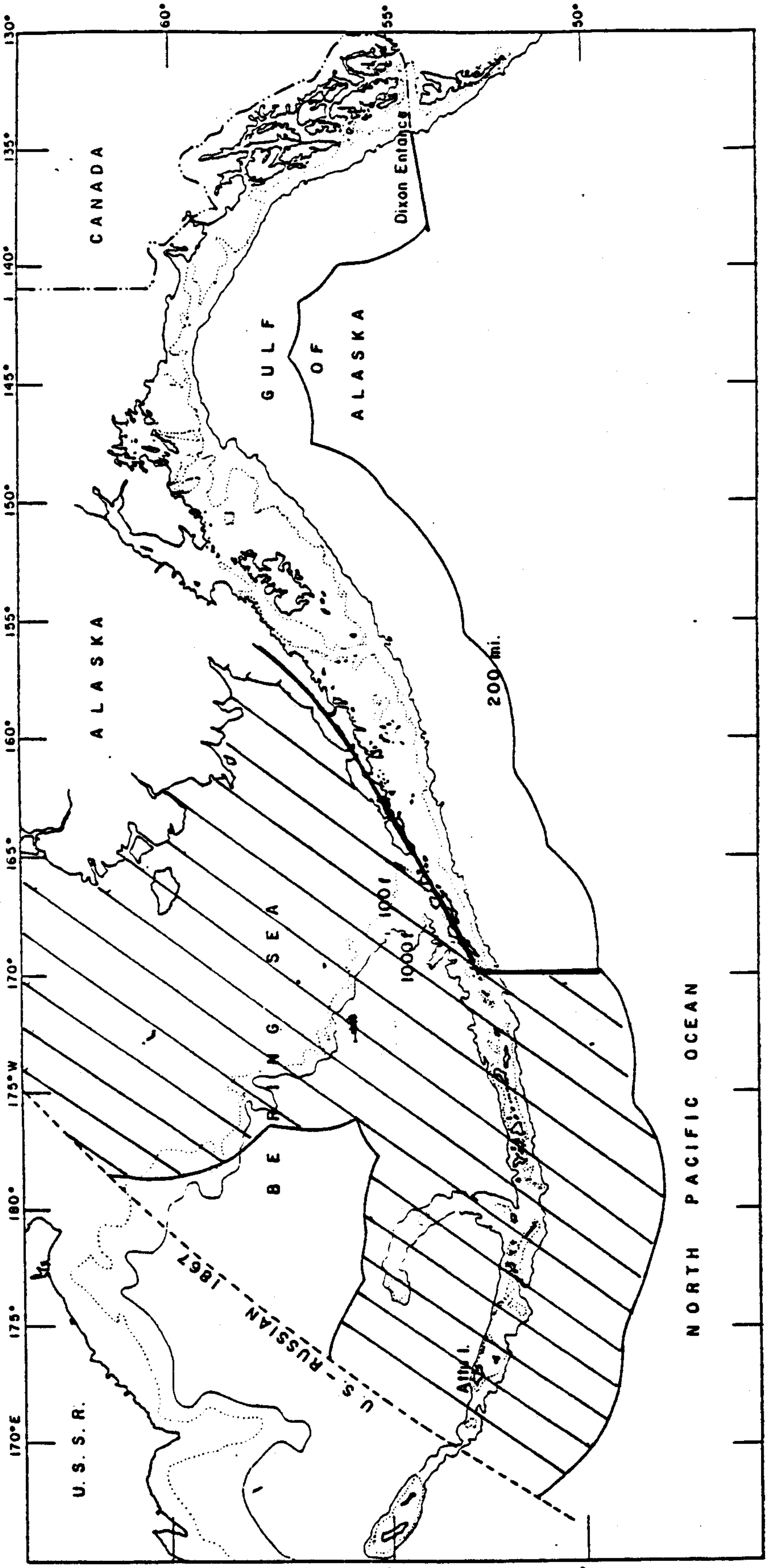

Figure 26.--Area (diagonal lines) over which this Fishery Management Plan applies.

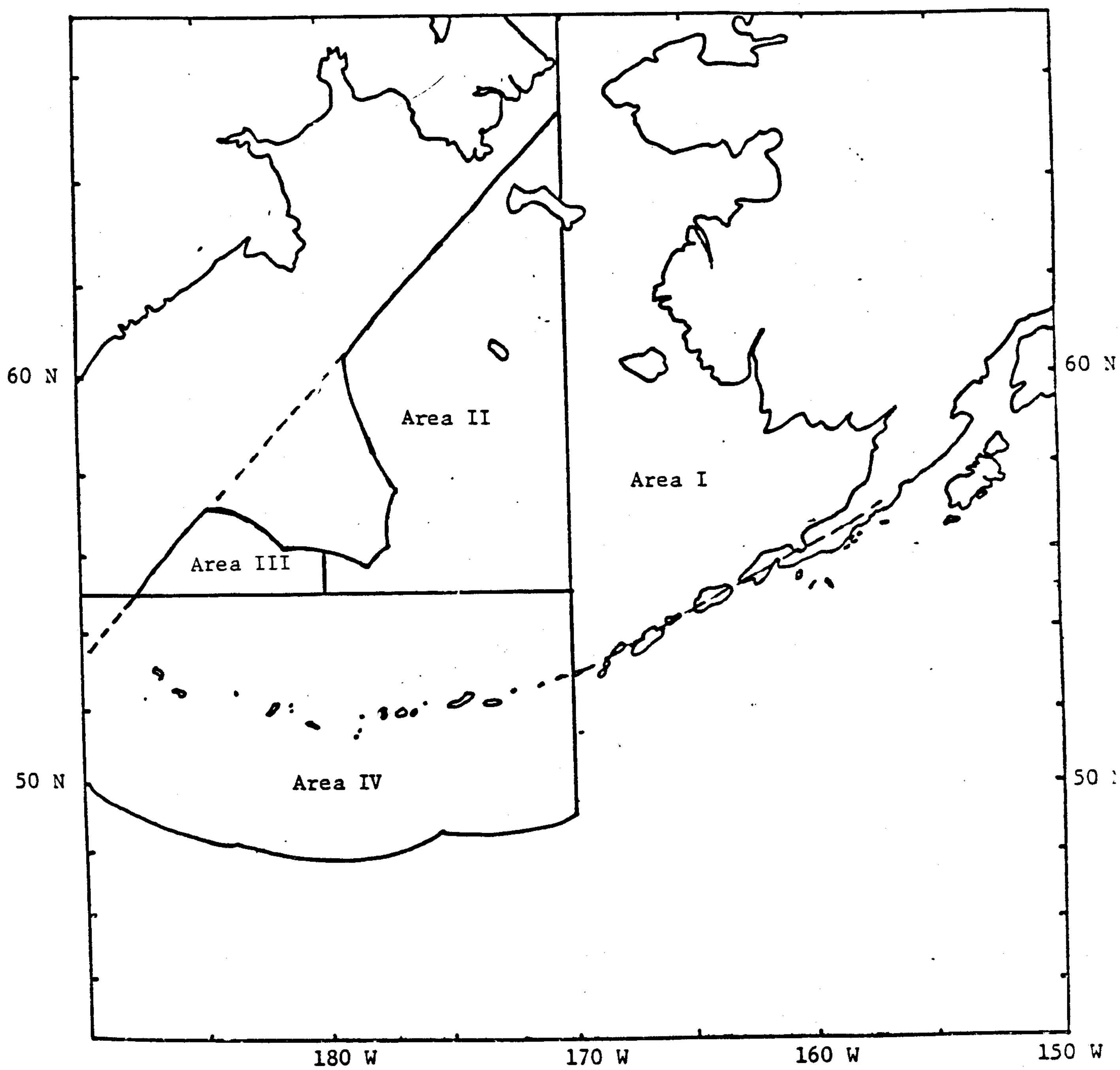

Fig. 26a Fishing areas in the Bering Sea and Aleutian Islands. (See Appendix III for geographical coordinates.)

3. Other Species -- species groups which currently are of slight economic value and not generally targeted upon. This category, however, contains species with economic potential or which are important ecosystem components, but sufficient data are lacking to manage each separately. Accordingly, a single TAC applies to this category as a whole. Catch of this category as a whole must be recorded and reported. The category includes sculpins, sharks, skates, eulachon, smelts, capelin, and octopus.

4. Nonspecified species -- are those species and species groups of no current economic value taken by the groundfish fishery only as an incidental catch in the target fisheries. These species include those listed in Annex V. Virtually no data exist which would allow population assessments. No record of catch is necessary. The TAC for this category is the amount which is taken incidentally while fishing for target and other species, whether retained or discarded.

14.3 Fishing Year

Fishing seasons are defined as periods when harvesting groundfish is permitted. Fishing seasons will normally be within a calendar year, if possible, for statistical purposes, but could span two calendar years if necessary. In consultation with the Council, the Secretary will establish all fishing seasons by regulations that implement the FMP to accomplish the goals and objectives of the FMP, the Magnuson Act, and other applicable law. Season openings will remain in effect unless amended by regulations implementing the FMP.

The Council will consider the following criteria when recommending regulatory amendments:

- Biological: spawning periods, migration, and other biological factors.
- Bycatch: biological and allocative effects of season changes.
- Exvessel and wholesale prices: effects of season changes on prices.
- Product quality: producing the highest quality product to the consumer.
- Safety: potential adverse effects on people, vessels, fishing time, and equipment.
- Cost: effects on operating costs incurred by the industry as a result of season changes.
- Other fisheries: possible demands on the same harvesting, processing, and transportation systems needed in the groundfish fishery.
- Coordinated season timing: the need to spread out fishing effort over the year, minimize gear conflicts, and allow participation by all elements of the groundfish fleet.
- Enforcement and management costs: potential benefits of seasons changes relative to agency resources available to enforce and manage new seasons.
- Allocation: potential allocation effects among users and indirect effects on coastal communities.

14.4 Management Measures -- Domestic Fishery

14.4.1 Permit Requirements

All U.S. vessels that are fishing in the Bering Sea or Aleutian Islands sub management areas or are receiving fish from the Bering Sea or Aleutian Islands sub management area must have a current fishing permit issued annually by the Secretary of Commerce. Information required when applying for a Federal fishing permit is contained in 50 CFR 675.4 of domestic regulations implementing the FMP.

14.4.2 Prohibited Species

A. General

Pacific halibut, Pacific herring, Pacific salmon and steelhead, king crab, and Tanner crab are prohibited species and must be treated as described in Section 14.2.B.1. Groundfish species and species groups under this FMP for which the TAC has been achieved shall be treated in the same manner as prohibited species.

B. Objective

The objective of this section is to provide an environment which supports domestic harvesting of groundfish with an awareness of principles and techniques for keeping incidental catches of Pacific halibut, Pacific herring, Pacific salmon, steelhead, king crab, and Tanner crab to a minimum.

C. Guideline

Procedures chosen for controlling the incidental catch of prohibited species should provide incentives and opportunities for fishermen to modify their gear, fishing techniques, or whatever else is appropriate to result in long-term incidental catch reductions.

D. Policy

The North Pacific Fishery Management Council believes that domestic fishermen targeting on the groundfish fisheries of the Bering Sea and Aleutians share a responsibility to avoid to the fullest extent practicable the incidental taking of halibut, salmon, king crab, and Tanner crab. They also share with the North Pacific Fishery Management Council a responsibility to develop an accurate information base concerning these species through maintenance of logbooks, accurate reporting of catch, and contributions to knowledge of fish distribution, behavior, etc.

The North Pacific Fishery Management Council advocates and strongly supports development of domestic harvesting and processing of the groundfish of the Bering Sea and Aleutian Islands. However, the Council also is fully committed to protection from needless waste of stocks of salmon, halibut, king crab, and Tanner crab which are fully utilized in other domestic fisheries. Furthermore, in accordance with MFCMA provisions, the Council has a continuing obligation to assure their management in accordance with optimum use objectives. Therefore, the Council charges domestic fishermen to develop their fishing strategies, techniques, and practices with full regard for and attention to the objectives of the Council for protection of species not properly a target of those groundfisheries, as demonstrated by the measures taken to assure protection by foreign fleets. The Council urges domestic fishermen to study the techniques used by foreign fleets to meet Council requirements for protection of non-target species, to adapt those techniques where appropriate for domestic use, and to experiment actively with gear modifications, selection of time and area fishing strategies designed to avoid concentrations of prohibited species, and other techniques designed to develop a clean fishery. The Council will work with domestic fishermen to facilitate transfer of useful information and technology from foreign sources, and to insure the collection of relevant fisheries data and information from all sources, foreign and domestic.

The Council will follow the development of Bering Sea and Aleutian Islands groundfish fisheries with much interest, and with particular attention to the success of those fisheries in avoiding unnecessary or excessive taking of prohibited species.

The Council hopes that through voluntary measures developed with the cooperation of domestic fishermen, stocks of salmon, halibut, king crab, and Tanner crab can be sufficiently sequestered from needless and wasteful bycatch to make unnecessary the imposition of special protective regulations upon the domestic groundfish fishery.

E. PSC Limits and Time/Area Closures for DAH Fisheries

The PSC limits and area closures for DAH fisheries will be reviewed each year to determine whether changes in prohibited species stock abundance or other factors justify consideration of alternative PSC limits or time/area closures.

14.4.2.1 Bycatch Limitation Zones

A. Zone 1 is that area bounded by 165°W longitude and 58°N latitude extending east to the shore (Figure 27).

B. Zone 2 is that area bounded by 165°W longitude, north to 58°N, then west to the intersection of 58°N and 171°W longitude, then north to 60°N, then west to 179°20'W longitude, then south to 59°25'N. latitude, then diagonally extending on a straight line southeast to the intersection of 167°W longitude and 54°30'N latitude, and then extending eastward along 54°30'N latitude to 165°W longitude (Figure 27).

C. Crab and Halibut Protection Zone. Domestic and foreign trawl fishing is not permitted in the Crab and Halibut Protection Zone. For the periods January 1 - March 14 and June 16 - December 31 of each fishing year the Crab and Halibut Protection Zone is defined as that portion of the EEZ north of the Alaska Peninsula, south of 58°N latitude, west of 160°W longitude and east of 162°W longitude. For the period March 15 - June 15 of each fishing year the Crab and Halibut Protection Zone is defined as that portion of the EEZ north of the Alaska Peninsula, south 58°N latitude, west of 160°W longitude and east of 163°W longitude (Figure 27).

D. The Halibut Protection Zone (Zone 2H) is that portion of Zone 2 south 56° 30'N latitude, west of 165°W longitude and east of 170°W longitude.

14.4.2.2 Prohibited Species Catch Limits

A. The DAH fishery for Pacific cod south of a straight line approximating the 25-fathom depth contour in the Crab and Halibut Protection Zone identified in 14.4.2.1 C is limited to a PSC of 12,000 red king crab.

B. The DAH trawl fisheries are limited to a PSC of 1,000,000 C. bairdi tanner crab and to a PSC of 200,000 red king crab in Zone 1 in any fishing year.

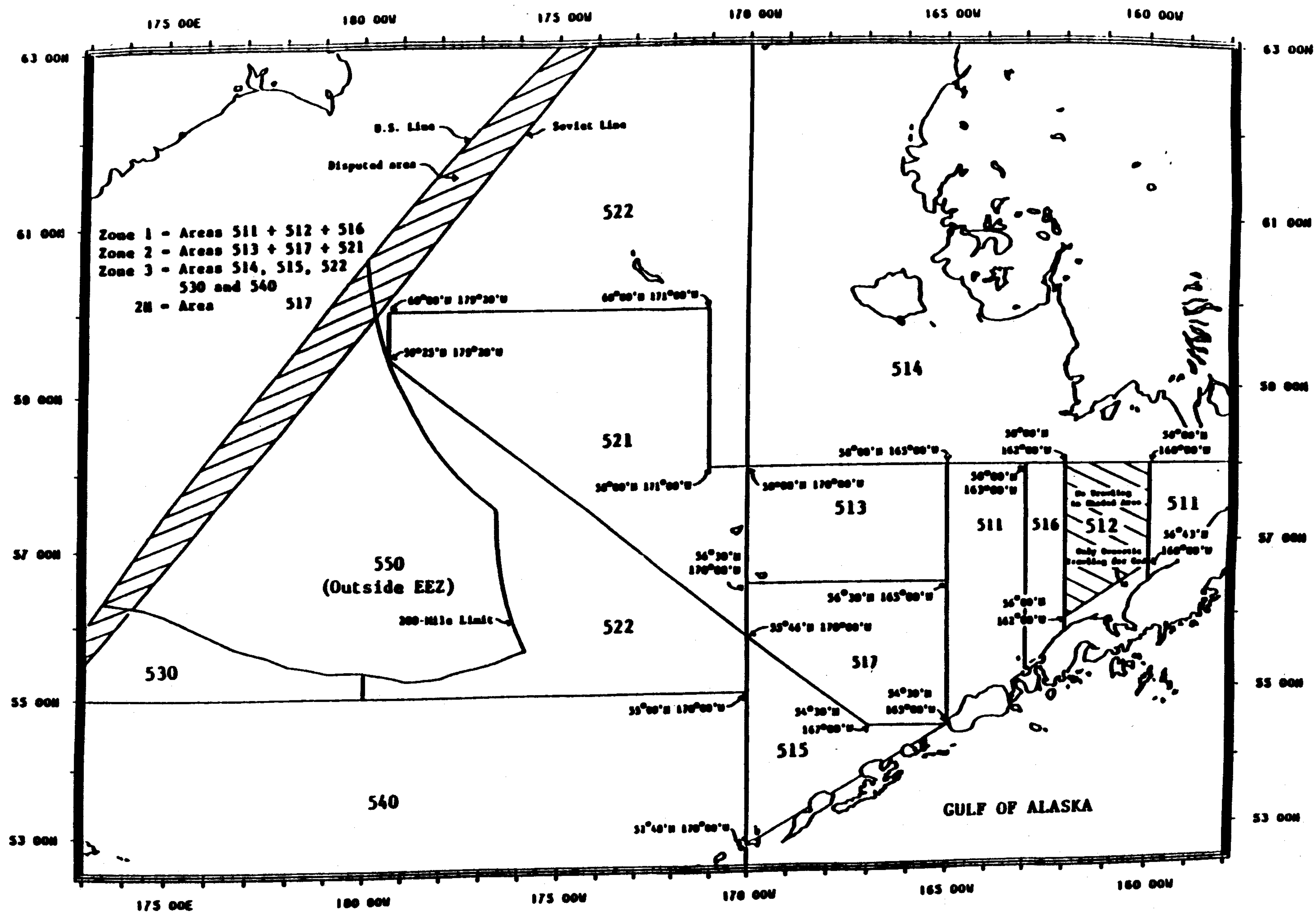

Figure 27. Description of Regulatory Areas and Bycatch Limitation Zones in the Bering Sea/Aleutian Islands.

C. The DAH trawl fisheries are limited to PSC of 3,000,000 C. bairdi Tanner crab in Zone 2 in any fishing year.

D. Two PSC limits for Pacific halibut for DAH trawl fisheries are established: a Zone 1 & 2 H limit of 4,400 mt and a BSAI-wide limit of 5,333 mt.

14.4.2.3 Apportionment of PSC Limits to Target Fisheries

A. The PSC limits for prohibited species apply to DAH (DAP and JVP) trawl fisheries for groundfish that are categorized by target species or species groups. Fishery categories will be implemented by regulations that accomplish the goals and objectives of the FMP, the Magnuson Act, and other applicable law. Fishery categories will remain in effect unless amended by regulations implementing the FMP. When recommending a regulatory amendment to revise fishery categories, the Council will consider the best information available on whether recommended fishery categories would best optimize groundfish harvests under the PSC limits established under Section 14.4.2.2.

B. Apportionments of PSC limits to target fishery categories established under Part A of this section and seasonal allocations of those apportionments may be determined annually by the Secretary of Commerce, after consultation with the Council, using the following procedure:

(1) Prior to the September Council meeting. The Plan Team will prepare for the Council a preliminary Stock Assessment and Fishery Evaluation (SAFE) Report under Section 11.3 which provides the best available information on estimated prohibited species bycatch and mortality rates in the target groundfish fisheries, and estimates of seasonal and annual bycatch rates and amounts. Based on the SAFE report, the Plan Team will provide recommendations for apportionments of PSC limits to DAP and JVP target fisheries, seasonal allocations, thereof, and an economic analysis of the effects of the PSC limit apportionments or allocations.

(2) September Council meeting. While setting preliminary groundfish harvest levels under Section 11.3, the Council will also review the need to control the bycatch of prohibited species and will recommend appropriate apportionment of PSC limits to DAP and JVP target fisheries in a manner that will optimize total groundfish harvest under established PSC limits, taking into consideration the anticipated amounts of incidental catch of prohibited species in each fishery category. The Council will also review the need for seasonal allocations of the PSC limit apportionments.

The Council will consider the best available information when recommending fishery apportionments of PSC limits and seasonal allocation of those apportionments, including that contained in the preliminary SAFE report prepared by the Plan Team. Types of information that the Council will consider relevant to seasonal allocation of fishery bycatch quotas include:

(a) Seasonal distribution of prohibited species;
(b) Seasonal distribution of target groundfish species relative to prohibited species distribution,
(c) Expected prohibited species bycatch needs on a seasonal basis relevant to changes in prohibited species biomass and expected catches of target groundfish species,

(d) Expected bycatch rates on a seasonal basis,
(e) Expected changes in directed groundfish fishing seasons,
(f) Expected start of fishing effort, and
(g) Economic effects of establishing seasonal halibut allocations on segments of the target groundfish industry.

(3) As soon as practicable after the Council's September meeting, the Secretary will publish the Council's recommendations as a notice in the Federal Register. Information on which the recommendations are based also will be published in the Federal Register or otherwise made available by the Council. Public comments will be invited by means specified in regulations implementing the FMP.

(4) Prior to the December Council meeting. The Plan Team will prepare for the Council a final SAFE report under Section 11.3 which provides the best available information on estimated halibut bycatch rates in the target groundfish fisheries. The Plan Team will provide final recommendations for apportionments of PSC limits among DAP and JVP target fisheries, seasonal allocations of fishery bycatch apportionments, and also an economic analysis of the effects of the PSC limit apportionments or seasonal allocations.

(5) December Council meeting. While setting final groundfish harvest levels, the Council reviews public comments, takes public testimony, and makes final decisions on apportionment of PSC limits among fisheries and seasonal allocations, using the same factors (a) through (g) set forth under Section 14.4.2.3, Part B (seasonal allocations of the PSC limits). The Council will recommend its decisions, including no change for the new fishing year, to the Secretary of Commerce for implementation.

(6) As soon as practicable after the Council's December meeting, the Secretary will publish the Council's final decisions as a notice in the Federal Register. Information on which the final recommendations are based will also be published in the Federal Register or otherwise made available by the Council.

14.4.2.4 Incentive programs to reduce bycatch rates of prohibited species

The Secretary of Commerce, after consultation with the Council, may implement by regulation measures that provide incentives to individual vessels to reduce bycatch rates of prohibited species for which PSC limits are established under Section 14.4.2.2. The intended effect of such measures is to increase the opportunity to harvest groundfish TACs before established PSC limits are reached.

14.4.3 Fishing Area Restrictions

14.4.3.1 General

Waters seaward of the State of Alaska three-mile limit, out to twelve miles surrounding (1) Round Island and the Twins and (2) Cape Peirce, are closed to fishing for groundfish from April 1 through September 30 (Figure 27a depicts the closed waters). This measure is effective through December 31, 1991.

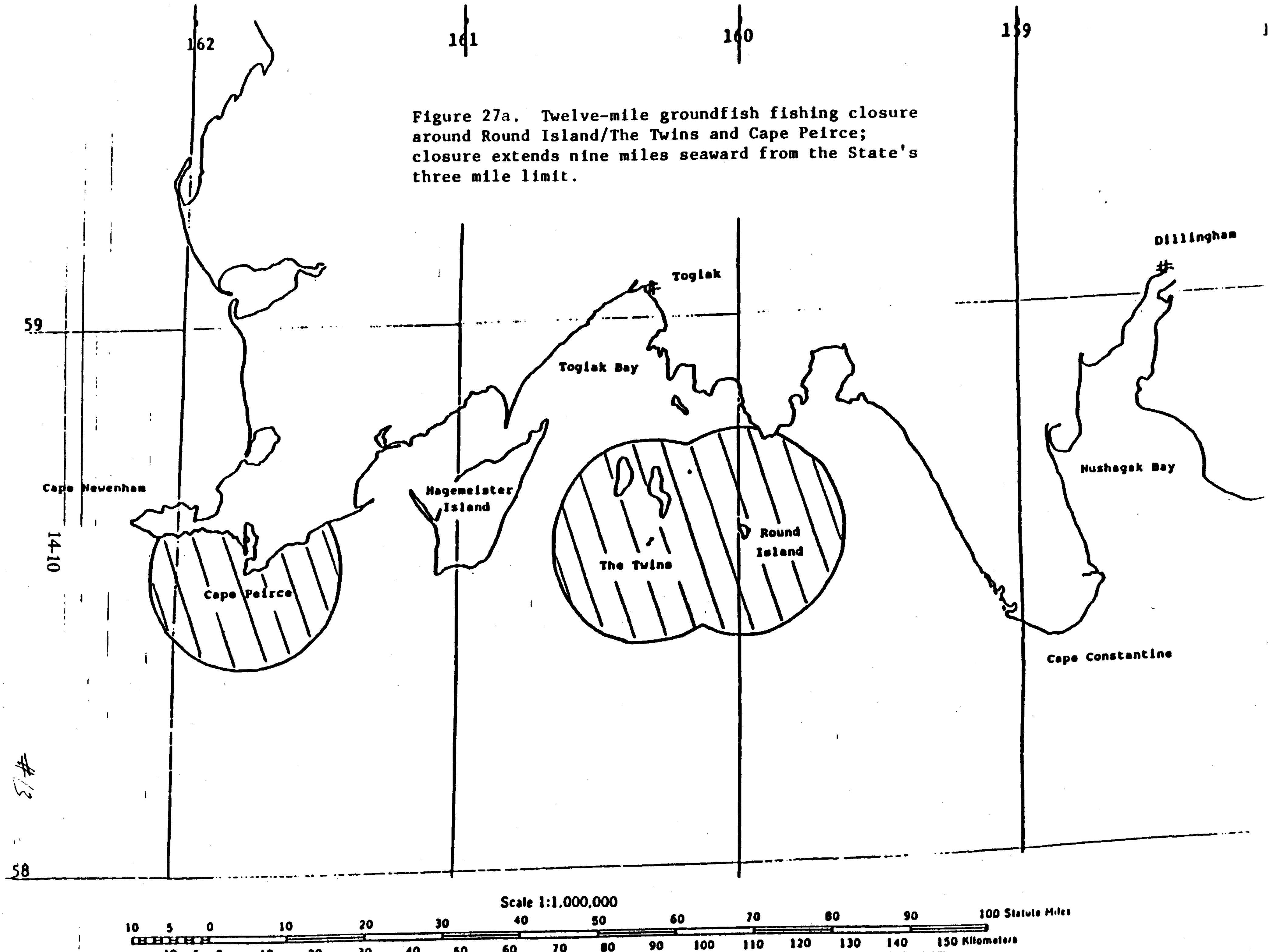

Figure 27a. Twelve-mile groundfish fishing closure around Round Island/The Twins and Cape Peirce; closure extends nine miles seaward from the State's three mile limit.

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14.4.3.2 Trawl Fishery

A. Area A -- "Bristol Bay Pot Sanctuary" (as described in Appendix III and Figure 27b) -- Reserved.

B. Area B -- "Winter Halibut Savings Area" (as described in Appendix III and Figure 27b):

(1) December 1 - May 31 -- domestic trawling will be permitted on an experimental basis and closely monitored.
(2) June 1 - November 30 -- no closures.

Rationale: To measure incidental catches and mortality of juvenile halibut which are known to occur in winter concentrations in the Bristol Bay Pot Sanctuary and the Winter Halibut Savings Area while allowing some expansion in the traditional crab-bait trawl fishery and the development of a domestic groundfish fishery for human consumption.

C. Other Areas -- Crab and Halibut Protection Zone -- (as described in Appendix III and Figure 27) -- Closed to all trawling from January 1 through December 31.

14.4.3.3 Longline Fishery -- no closures

14.4.3.4 Implementation of Time and Area Limitations (Reserved)

When a DAP or JVP target fishery specified in regulations attains a PSC limit apportionment or seasonal allocation specified in regulations, the bycatch zone(s) or management area(s) to which the PSC limit apportionment or seasonal allocation applies will be closed to that target fishery (or components thereof) for the remainder of the year or season, whichever is applicable.

14.4.4 Gear Restrictions

Gear types authorized by the FMP are trawls, hook-and-line, pots, jigs, and other gear as defined in regulations. Further restrictions on gear that are necessary for conservation and management of fishery resources and which are consistent with the goals and objectives of the FMP are found at 50 CFR Part 675.

14.4.5 Reporting Requirements

A. Domestic

The Council and NOAA Fisheries must have the best available biological and socioeconomic information with which to carry out their responsibilities for conserving and managing groundfish resources, as well as other fish resources, such as crab, halibut, and salmon, that are incidentally caught in the groundfish fishery. This information is used for making inseason and inter-season management decisions that affect these resources as well as the fishing industry that utilize them. This information is also used to judge the effectiveness of regulations guiding these decisions. The Council will recommend changes to regulations when necessary on the basis of such information.

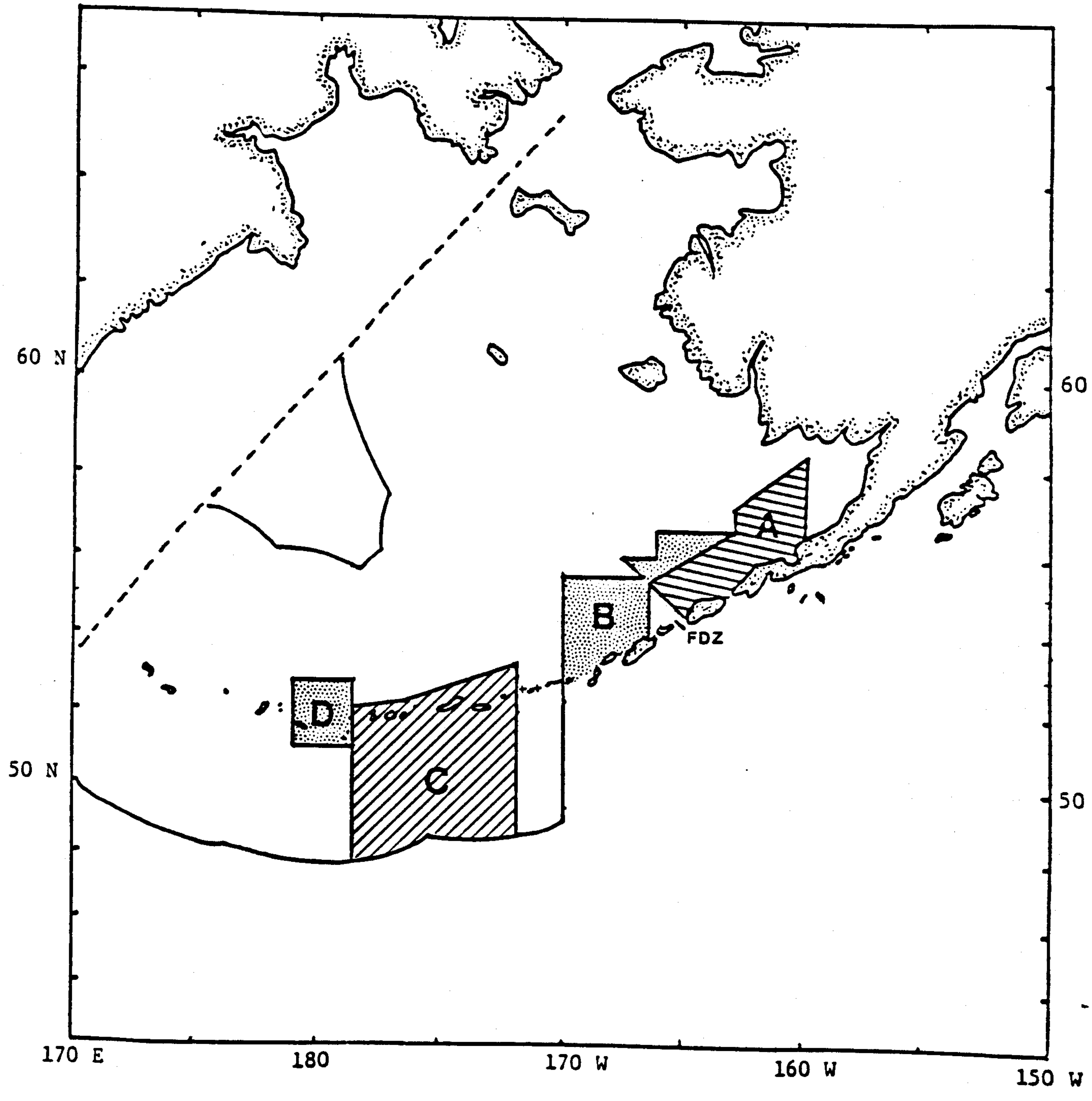

Fig. 27b. **Areas with special restrictions on foreign and/or domestic fisheries in the Bering Sea and Aleutian Islands Groundfish Plan area.**

The need for the Council and NOAA Fisheries to consider the best available information is explicit in the goals and objectives as established by the Council and contained in the FMP. They are also explicit in the Magnuson Act, Executive Order 12291, the Regulatory Flexibility Act, the National Environmental Policy Act, and other applicable law. The Secretary, therefore, will require segments of the fishing industry to keep and report certain records as necessary to provide the Council and NOAA Fisheries with the needed information to accomplish these goals and objectives. The Secretary may implement and amend regulations at times to carry out these requirements after receiving Council recommendations to do so, or at other times as necessary to accomplish these goals and objectives. Regulations will be proposed and implemented in accordance with the Administrative Procedure Act, the Magnuson Act, and other applicable law.

Information on catch and production, effort, and price. In consultation with the Council, the Secretary may require recordkeeping that is necessary and appropriate to determine catch, production, effort, price, and other information necessary for conservation and management of the fisheries. Such requirements may include the use of catch and/or product logs, product transfer logs, effort logs, or other records. The Secretary may require the industry to submit periodic reports or surveys of catch and fishery performance information derived from the logs or other recordkeeping requirements. Recordkeeping and reporting would be required of operators of catcher vessels, catcher/processor vessels, mothership processor vessels, and by responsible officers of shoreside processor plants. Such requirements will be contained in regulations implementing this FMP.

Information on processing expectations. In consultation with the Council, the Secretary may require U.S. processors and persons delivering U.S.-caught fish to foreign processing vessels to submit information to the Regional Director that is necessary and appropriate to reassess the adequacy of DAP and JVP specifications. Such information may be collected by means of written or telephone surveys. Such requirements will be contained in regulations implementing this FMP.

Information on catching and/or processing activity. The Secretary may require catcher/processor vessels and mothership processor vessels to submit check-in and check-out reports for any Federal statistical area and the Territorial Sea adjacent to the Federal Statistical area. Such requirements will be contained in regulations implementing this FMP.

B. Processor Reports

All processors of groundfish shall report information necessary for the periodic reassessment of DAP. The regulation implementing this plan specify the information to be reported and the time schedule for reporting.

C. Joint Venture Reports

Persons delivering U.S. caught groundfish to foreign processing vessels shall report information required for periodic reassessment of that portion of the DAH to be delivered to foreign processors (JVP). The regulations implementing this plan specify the information to be reported and the time schedule for reporting.

D. At-Sea Processor Vessels

1. Reporting requirements. Vessels that catch and process groundfish at sea (catcher/processors) and vessels that receive catch from other vessels for processing (mothership/ processors) have the ability to operate for extended periods without landing. To avoid delay in monitoring catches, catcher processors and mothership/processors are required to report to the Director, Alaska Region, NMFS, at regular intervals as specified in the regulations.

2. Check-in and check-out report. Catcher/processors are required to check in and check out of any fishing area for which total allowable catch (TAC) is established within a time period prescribed by regulation. This report may be by radio through the U.S. Coast Guard to the Director, National Marine Fisheries Service. The NPFMC intends that this requirement will enhance the National Marine Fisheries Service's ability to monitor the timeliness of the written catch reports described in (1) above and to assess the total harvest capacity in a fishing area for purposes of projecting dates when a TAC, or apportionment of TAC, will be reached.

3. Catch/receipt and product transfer report. Operators of catcher/processor and mothership/processor vessels must submit a weekly catch/receipt and product transfer report. This report will be required after notification of starting fishing by a vessel and continuing until that vessel's entire catch or cargo of fish has been off-loaded for each weekly period, Sunday through Saturday, or for each portion of such a period. This report must be sent to the Regional Director within one week of the end of the reporting period through such means as the Regional Director will prescribe by regulations and must contain the following information:

   (a) Name and radio call sign of the vessel.
   (b) Federal permit number for the Bering Sea and Aleutian Islands groundfish fisheries.
   (c) Month and days fished or during which fish were received at sea.
   (d) The estimated round weight of all fish caught or received at sea by that vessel during the reporting period by species or species group, rounded to the nearest one-tenth of a metric ton (0.1 mt), whether retained, discarded, or off-loaded.
   (e) The number of cartons of product and the unit net weight, in kilograms or pounds, of each carton of processed fish by species or species group produced by that vessel during the reporting period.
   (f) The area in which each species or species group was caught.
   (g) If any species or species groups were caught in more than one area during a reporting period, the estimated round weight of each, rounded to the nearest 0.1 mt by area.
   (h) The product weight, rounded to the nearest one-tenth of a metric ton (0.1 mt), and the number of cartons transferred or off-loaded by product type and by species or species group.

4. Cargo transfer/off-loading log. Operators of catcher/processor and mothership/processor vessels must record certain information in a separate transfer log. He must record, for each transfer or off-loading of any fishery product in the EEZ, and also quantities transferred or off-loaded outside the EEZ, within any states'

territorial waters, or within the internal waters of any state, the following information within a time specified by regulations:

(a) The time and date (GMT) and location (in geographic coordinates or if within a port, the name of the port) the transfer began and was completed.
(b) The product weight and product type, by species or species group of all fish products transferred or off-loaded rounded to the nearest tenth of a metric ton (0.1 mt).
(c) The name and permit number of vessel off-loading to or, if to a shoreside facility, the name of the commercial facility receiving the product.
(d) The intended port of destination of the receiving vessel if off-loaded to another vessel.

14.4.6 Domestic Observer Program

As in the need for reporting requirements, the Council and NOAA Fisheries must have the best available biological and socioeconomic information with which to carry out their responsibilities for conserving and managing groundfish resources. To augment this information, the Secretary, in consultation with the Council, will require each U.S. fishing vessel that catches groundfish from, or receives groundfish from the EEZ, and each shoreside processor that receives fish caught in the EEZ, to accommodate a observer certified by NOAA Fisheries. Such accommodation may be exempt from this requirement under an Observer Plan prepared by the Council according to regulations implementing this FMP. The purpose of the at-sea observer requirement is to verify catches, including those discarded at sea, and collect biological information of types required in the Observer Plan, which will include information on marine mammals and birds. Observers associated with the Marine Mammal Protection Act Observer Program will be considered to be observers for purposes of the Observer Plan if they meet requirements of observers for this Program.

14.4.7 Limited Entry

Implementation of a limited entry program will not be necessary for this fishery during the first few years that it operates under this plan. However, a limited entry program should be designed by the Council during the early stages of domestic fishery development so that it can be implemented well before the time that the fishery becomes fully or over-capitalized.

14.4.8 Inseason Adjustments

Harvest levels for each groundfish species or species group that are set by the Council for a new fishing year are based on the best biological, ecological, and socioeconomic information available. The Council finds, however, that new information and data relating to stock status may become available to the Regional Director and/or the Council during the course of a fishing year that warrants inseason adjustments in a fishery. Such changes in stock status might not have been anticipated or were not sufficiently understood at the time harvest levels were being set. Such changes may become known from events within the fishery as it proceeds, or they may become known from new scientific survey data. Certain changes warrant swift action by the Regional Director to protect the resource from biological harm by instituting gear modifications or adjustments through closures or restrictions. Other changes warrant action by the Regional Director to provide greater fishing opportunities for the industry by instituting time/area adjustments through openings or extension of a season beyond a scheduled closure.

The need for adjustment may be related to several circumstances. For instance, certain target or bycatch species may have decreased in abundance. When current information indicates that a species has decreased in abundance, allowing a fishery to continue to a harvest level now known to be too high could increase the risk of overfishing that species. Likewise, current information relating to prohibited species, i.e., those species that must be returned to the sea, might become available that indicates their abundance has decreased. Conservation measures limited to establishing prohibited species catch (PSC) limits for such prohibited species may be necessary during the course of the fishery to prevent jeopardizing the well-being of prohibited species stocks.

When current information demonstrate a harvest level to have been set too low, closing a fishery at the annually specified harvest level would result in underharvesting that species, which also results in the fishery unnecessarily foregoing economic benefits during that year unless the total allowable catch were increased and the fishery allowed to continue.

Similarly, current information may indicate that a prohibited species was more abundant than was anticipated when (PSC) limits were set. Closing a fishery on the basis of the preseason PSC limit that is proven to be too low would impose unnecessary costs on the fishery. Increasing the PSC limits may be appropriate if such additional mortality inflicted on the prohibited species of concern would not impose detrimental effects on the stock or unreasonable costs on a fishery that utilize the prohibited species. However, adjustments to target quotas or PSC limits which are not initially specified on the basis of biological stock status is not appropriate.

The Council finds that inseason adjustments are accomplished most effectively by management personnel who are monitoring the fishery and communicating with those in the fishing industry who would be directly affected by such adjustments. Therefore, the Council authorizes the Secretary by means of his delegation to the Regional Director, NMFS, to make inseason adjustments to conserve fishery resources on the basis of all relevant information. Using all available information, he may extend, open or close fisheries in any or part of a regulatory area, or restrict the use of any type of fishing gear as a means of conserving the resource. He may also change any previously specified TAC or PSC limit if such are proven to be incorrectly specified on the basis of the best available scientific information or biological stock status. Such inseason adjustments must be necessary to prevent one of the following occurrences:

(a) The overfishing of any species or stock of fish, including those for which PSC limits have been set.

(b) The harvest of a TAC for any groundfish, the taking of a PSC limit for any prohibited species, or the closure of any fishery based on a TAC or PSC limit which on the basis of currently available information is found by the Secretary to be incorrectly specified.

The types of information which the Regional Director must consider in determining whether stock conditions exist that require an inseason management response are described, as follows, although he is not precluded from using information not described but determined to be relevant to the issue.

(a) The effect of overall fishing effort within a regulatory area.
(b) Catch per unit of effort and rate of harvest.
(c) Relative abundance of stocks within the area.
(d) The condition of the stock within all or part of a regulatory area.
(e) Any other factors relevant to the conservation and management of groundfish species or any incidentally caught species which are designated as a prohibited species or for which a PSC limit has been specified.

The Regional Director is constrained, however, in his choice of management responses to prevent potential overfishing by having to first consider the least restrictive adjustments to conserve the resource. The order in which the Regional Director must consider inseason adjustments to prevent overfishing are specified as: (1) any gear modification that would protect the species in need of conservation protection, but which would still allow fisheries to continue for other species; (2) a time/area closure which would allow fisheries for other species to continue in non-critical areas and time periods; and (3) total closure of the management area and season.

The procedure which the Secretary must follow requires that the Secretary publish a notice of proposed adjustments in the Federal Register before they are made final, unless the Secretary finds for good cause that such notice is impracticable or contrary to the public interest. If the Secretary determines that the prior comment period should be waived, he is still required to request comments for 15 days after the notice is made effective, and respond to any comments by publishing in the Federal Register either notice of continued effectiveness or a notice modifying or rescinding the adjustment.

To effectively manage each groundfish resource throughout its range, the Regional Director must coordinate inseason adjustments, when appropriate, with the State of Alaska to assure uniformity of management in both State and Federal waters.

Any inseason time/area adjustments made by the Regional Director will be carried out within the authority of this FMP. Such action is not considered to constitute an emergency that would warrant a plan amendment within the scope of section 305(e) of the Magnuson Act. Any adjustments will be made by the Regional Director by such procedures provided under existing law. Any inseason adjustments that are beyond the scope of the above authority will be accomplished by emergency regulations as provided for under section 305(e) of the Magnuson Act.

14.4.9 Gear allocations

The following gear allocations are specified by this plan:

Bering Sea Subarea

Starting in 1990, vessels using fixed gear, including hook-and-line and pot gear, shall be permitted to harvest no more than 50 percent of the TAC specified for sablefish. Vessels using trawl gear shall be permitted to harvest no more than 50 percent of the TAC specified for sablefish.

Aleutian Islands Subarea

Starting in 1990, vessels using fixed gear, including hook-and-line and pot gear, shall be permitted to harvest no more than 75 percent of the TAC specified for sablefish. Vessels using trawl gear shall be permitted to harvest no more than 25 percent of the TAC specified for sablefish."

14.4.10 Utilization and seasonal allowances of the pollock TAC

Roe-stripping of pollock is prohibited, and the Regional Director is authorized to issue regulations to limit this practice to the maximum extent practicable. It is the Council's policy that the pollock harvest shall be utilized to the maximum extent possible for human consumption.

The pollock TAC shall be divided into two allowances: roe-bearing and non roe-bearing. Each allowance will be available for harvest during the times specified in the regulations. The proportion of the annual pollock TAC assigned to each allowance will be determined annually during the groundfish specifications process. Proposed and final notices of the seasonal allowances of the pollock TAC will be published in the Federal Register with the proposed and final groundfish specifications.

The following factors will be considered when setting seasonal allowances of the pollock TAC:

(1) estimated monthly pollock catch and effort in prior years;

(2) expected changes in harvesting and processing capacity and associated pollock catch;

(3) current estimates of and expected changes in pollock biomass and stock conditions; conditions of marine mammal stocks, and biomass and stock conditions of species taken as bycatch in directed pollock fisheries;

(4) potential impacts of expected seasonal fishing for pollock on pollock stocks, marine mammals, and stocks of species taken as bycatch in directed pollock fisheries;

(5) the need to obtain fishery-related data during all or part of the fishing year;

(6) effects on operating costs and gross revenues;

(7) the need to spread fishing effort over the year, minimize gear conflicts, and allow participation by various elements of the groundfish fleet and other fisheries;

(8) potential allocative effects among users and indirect effects on coastal communities; and

(9) other biological and socioeconomic information that affects the consistency of seasonal pollock harvests with the goals and objectives of the FMP.

14.5 Management Measures -- Foreign Fisheries

14.5.1 Permit Requirements

All foreign vessels operating in this management unit shall have on board a permit issued by the Secretary of Commerce pursuant to the Magnuson Act.

14.5.2 Prohibited Species

A. General

Pacific halibut, Pacific herring, salmonids, king crab, and Tanner crab are prohibited species and must be treated as described in Section 14.2.B.1. Records of catches of these species must be kept. Any groundfish species not allocated to foreign fishermen must be treated as described in Section 14.2.B.1. Records of catches of these species must be kept. Catches of "nonspecified" species as described in Section 14.2.B.4 and Annex V must be treated as prohibited species, except that catch records are not required.

1. Purpose. The purpose of this section is to reduce the amount of prohibited species taken incidentally in the extensive foreign groundfish fisheries operating in the management area.

2. Objectives. The objective of this section is to effect incremental reductions in the catch of prohibited species by the foreign groundfish fisheries consistent with the need to provide opportunities to catch the TALFF of groundfish and consistent with the considerations in part "E" of this section.

3. Guideline. The procedures chosen for controlling the incidental catch of prohibited species should provide incentives and opportunities for fishermen to modify their gear, fishing techniques, or whatever is appropriate to reduce the incidental catch of prohibited species so that long-term solutions will result from their actions.

4. Restricted Gear. The management regime prescribed in this section applies to all foreign trawl fisheries in the FMP management area. The foreign longline fisheries are exempted from the management measures prescribed for salmon, Pacific halibut, king crab, and Tanner crab in this section. The foreign longline fishery will be monitored closely for its impact on these species.

   The Secretary, after consultation with the Council, shall include foreign longliners in regulations promulgated under this section if they are determined to have a detrimental impact on prohibited species.

B. C. Bairdi Tanner Crab PSC Limits

A limit of 64,000 C. bairdi Tanner crabs applicable to the foreign directed fisheries for yellowfin sole and other flatfish is established in the combined areas of Zones 1 and 2 as described in Appendix III.

C. Target Reduction Schedule of Prohibited Species Catch Rates for Pacific Halibut, King Crab, and Tanner Crab

This part establishes target prohibited species catch rates for Pacific halibut, king crab, and Tanner crab, and provides that elements of the foreign groundfish fishery may be closed if the resulting prohibited species catches (PSCs) are exceeded. Prohibited species catch rates will be gradually reduced over a fixed period, with the intent to reduce total PSCs.

PSCs will be determined each year based on target catch rates and the amount of TALFF available each year. They may be further adjusted according to the considerations listed in part "E" of this section.

Target catch rates have been established by following three steps:

(1) determination of base PSC rates for measurement;
(2) determination of target rate and period of reduction; and
(3) determination of the annual percentage rate of reduction.

1. Base PSC rates for measurement. The average incidental catch of prohibited species and the average trawl groundfish catch by foreign nations during 1977-80 were used

to calculate the catch rate (prohibited species/total groundfish) as the base level rates for each prohibited species from which PSCs were determined.

2. Target rates and period of reduction. Target rate and period of reduction for each prohibited species vary and were determined as follows:

Pacific halibut - 50% reduction in 5 years.

Rationale: This reduction was chosen by the Council rather than a more stringent one because of the difficulty of avoiding halibut in the yellowfin sole fishery.

King and Tanner Crabs - 25% reduction in 5 years.

Rationale: This reduction was chosen by the Council to accurately reflect conditions in these fisheries, i.e. (1) the slight biological impact of the incidental catch on the crab populations, and (2) the lesser socioeconomic impact of the incidental catches on the domestic crab fishing industry. As reported in Reeves (1981, Council Document #13) most of the crab taken are golden king crabs (72%-91% of king crab by-catch) and Chionoecetes opilio (59%-76% of Tanner crab by-catches).

3. Annual percentage rate of reduction. A straight line schedule of reduction from the base catch rates was adopted to derive annual target rates (R) for incidental catch of each prohibited species, as shown in Table 25.

Based on current information, Council Document #13 (1981), the established catch rates in Table 25 will fulfill the objective of Part "A" of this section. However, it is conceivable that changes to the stocks and the fishery could occur, in which case the established catch rates may no longer meet the objective and therefore shall be adjusted as described in part "E" of this section.

D. Annual Determination of PSC Levels for Pacific Halibut, King Crab, and Tanner Crab

The incidental catch rate reduction schedules for halibut and crabs are expressed as percentage reductions of the average 1977-80 incidental catch rates (weight or number of prohibited species per metric ton of groundfish caught). Since the amount of TALFF and reserves cannot yet be determined by year (year i), the absolute amount of PSC for halibut and crabs (species j) will be determined each year as follows:

$$PSC_{ij} = R_{ij} \times TALFF$$

Using this formula, the PSC for halibut and crabs will increase throughout the year as TALFF is increased through the apportionment of groundfish reserves and surplus DAH to TALFF.

The calculated PSCs will be reviewed annually and may be adjusted by the Regional Director, in consultation with the Council, as provided for in the annual review process of part "E" of this section.

Table 25 -- Incidental catch rate reductions for Pacific halibut, king crab and Tanner crab, based on the average 1977-80 foreign trawl groundfish and prohibited species catches.

Year	Halibut[1]	King Crab[2]	Tanner Crab[2]
Base Catch Rates			
1977-80	3,182	16,804	16,003,329
Average	1,301,250	1,301,250	1,301,250
	base R=0.00245	base R=0.70456	base R=12.29843
Rate Reduction Schedule, R			
(1981)	--	--	--
(1982)	R=.00220 90%	R=.66933 95%	R=11.6840 95%
(1983)	R=.00196 80%	R=.63410 90%	R=11.0686 90%
(1984)	R=.00171 70%	R=.59887 85%	R=10.4537 85%
(1985)	R=.00147 60%	R=.56365 80%	R= 9.8387 80%
(1986)	R=.00122 50%	R=.52842 75%	R= 9.2238 75%

1/ Metric tons per metric ton of groundfish.
2/ Number of individuals per metric ton of groundfish.

When the Regional Director projects that a nation's groundfish allocation may not be reached due to premature achievement of PSC he will caution the nation to avoid further interception of prohibited species. Once the final PSC for halibut, king crab or Tanner crab is reached, the entire management area shall be closed to trawling by vessels of the affected nation, except to the extent exempted by the Regional Director for selected elements of the fleet to continue fishing as provided for in part "G" of this section.

E. Reducing the PSC of Salmon

The salmon catch reduction schedules in Table 26 are for chinook salmon and for all species of salmon combined. The chinook salmon incidental catch equals 93% of the all salmon incidental catch. The reduction schedule approved by the Council for chinook salmon was negotiated between the principal domestic and foreign user groups, western Alaskan residents and Japanese trawl industry representatives.

Salmon PSCs are indicated for 1981, 1982, 1983, 1984 and 1985. The objective is to achieve a 75% reduction from the 1981 level within five years, i.e., 16,250 chinook salmon and 17,473 for all salmon combined for the 1986 fishing year.

The salmon PSCs will be reviewed annually in accordance with part "E" of this section and a full and complete review of the salmon PSC reduction program shall be conducted in 1983 to determine the PSCs to be established thereafter. The review will consider the status of the chinook salmon resource, the economic and technological possibility of further PSC reductions, the economic and technological reasonableness of the goal for 1986, and other relevant matters.

The PSC reduction schedule for salmon is subject to the following conditions:

1. A rolling PSC limit which fixes the by-catch levels over a period of three successive years, will be in effect. In any year, a nation's incidental salmon catch may exceed the specified limit by up to 10%.

   Provided that the total incidental catch by that nation in any consecutive three-year period does not exceed the sum of the PSC limits for those three years.

   Note: All calculations of the rolling PSC limit shall start with the 1982 fishing season, regardless of when this section is implemented by the Secretary.

2. Once the rolling PSC limit is reached for salmon, Fishing Area II, as well as that part of Fishing Area I lying between 55°N and 57°N latitude and between 165°W and 170°W longitude, as shown in Figure 28, will be closed to trawlers of the affected nation, for so much of the months of January, February, March, October, November, and December which remain in that fishing year.

3. If any more salmon are caught in the areas which remain open, those catches will be deducted from the next year's salmon PSC of the affected nation consistent with the rolling PSC limit.

Table 26 -- Target reduction schedule of salmon prohibited species catches based on the average 1977-80 foreign trawl salmon incidental catch.

	Salmon	
Year	Chinook	Total Salmon[1/]
Base Numbers		
1977-80	74,400	80,000
Reduced Catch Levels		
(1981)	65,000	69,893
(1982)	55,250	59,409
(1983)	45,500	48,925
(1984)	35,750	38,441
(1985)	26,000	27,957
(1986)	16,250	17,473

1/ Total salmon numbers are calculated on the assumption that 93% of incidentally-caught salmon are chinook.

Note: A full and complete review of the salmon incidental catch reduction program will be conducted in 1983 to determine what the salmon incidental catch limits should be thereafter. This review will consider the status of the salmon resource, the economic and technological possibility of further incidental catch reductions, and other relevant matters. The review would also consider the economic and technological reasonableness of the goal set out above.

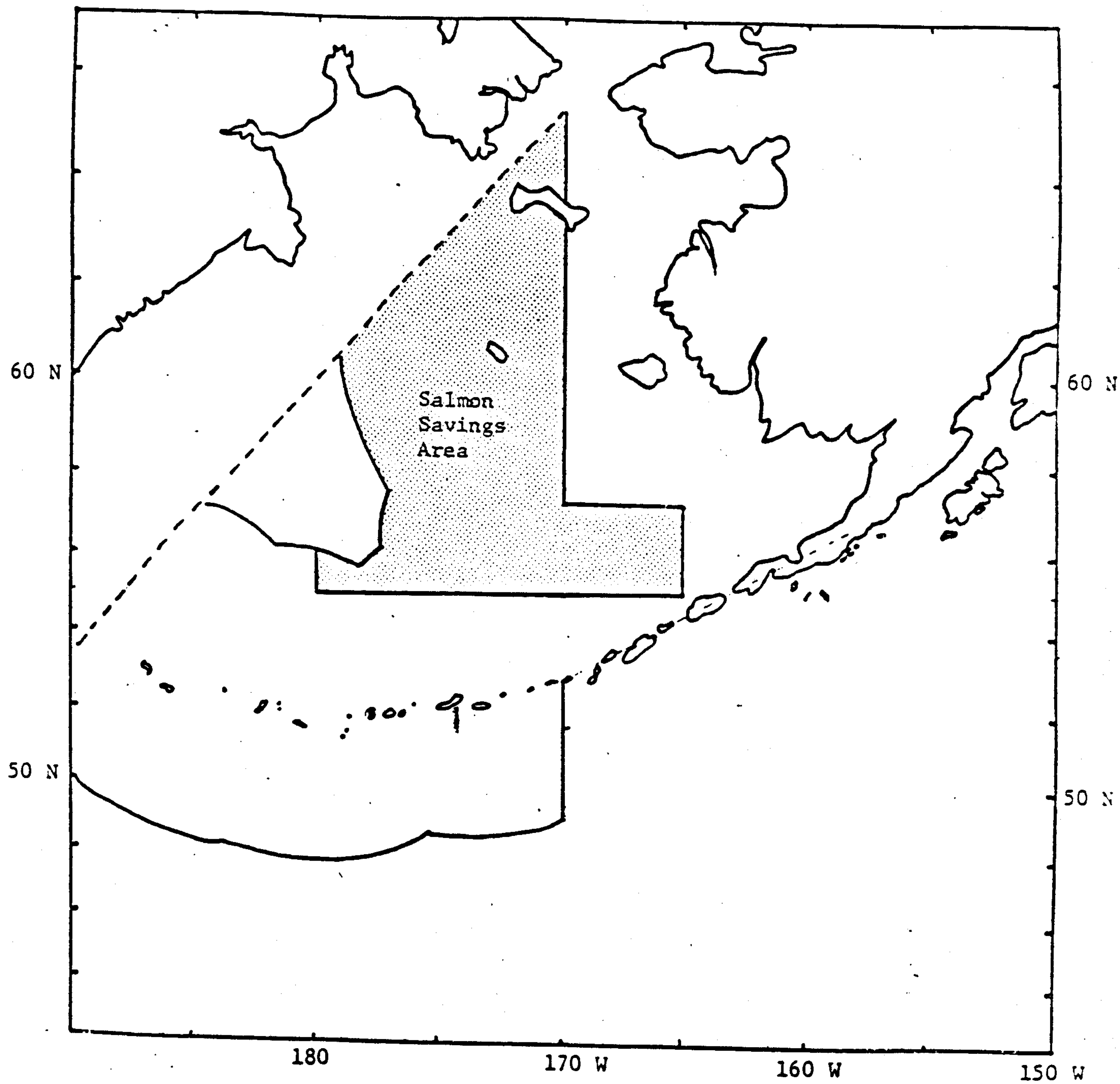

Fig. 28 Salmon Savings Area of the Bering Sea and Aleutian Islands Groundfish FMP (See Appendix III for geographical coordinates.)

F. Annual Review and Adjustment of PSCs

Since fisheries resources and socioeconomic conditions of the fishing community are expected to change, the PSC management system will be reviewed annually by the Council and the calculated PSCs and may be adjusted by the Regional Director, as a result of the Council's review. The annual review of calculated PSCs, target rates and period of reduction, and the percentage reduction in target rates from the previous year which are used to calculate PSCs is intended to respond to such changes to the stocks and the fishery as:

- changes in the stock condition and abundance of prohibited species;

- changes in stock condition and abundance of target groundfish species, except that in the annual reviews this will not be applied to salmon. However, it will be included in the three-year review which is referenced in part "D", and the note to Table 26;

- changes in the degree of socioeconomic impact of prohibited species' catches on domestic fisheries dependent on them; and

- changes in the impact on the ability of foreign fisheries to take their groundfish TALFF.

In the annual adjustments of PSCs, the Regional Director, in consultation with the Council, shall consider all of the following, in order of priority:

(1) the need to protect prohibited species for biological and other conservation reasons;
(2) the impact of PSCs on the domestic fisheries dependent on prohibited species;
(3) the impact of the PSC regulations on development and operation of domestic groundfish fisheries; and
(4) the impact of PSCs on the foreign groundfish fisheries.

Prior to the beginning of each fishing year, the latest technical information bearing on changes to the stocks and the fishery will be provided to the Regional Director and the Council so that decisions for adjusting PSCs can be made by the beginning of the fishing year. When the final PSCs are determined, the Regional Director will notify nations of such adjustments.

G. Distribution of PSCs to Foreign Nations

1. Pacific halibut, king crab and Tanner crab. The PSCs for Pacific halibut, king crab and Tanner crab (species j) in any year (year i) shall be distributed to each nation in direct proportion to a nation's groundfish allocation by the following equation:

Nation's PSCij equals Rij multiplied by Nation's Groundfish Allocation

Since the total PSCij for Pacific halibut, king crab and Tanner crab is based on an incidental catch rate and will increase throughout the fishing year as TALFF is increased, a nation's PSCij may also increase accordingly.

2. Salmon. A nation's share of the salmon PSC at the beginning of a fishing year is in the same proportion to the total salmon PSC as its initial groundfish allocation is to

the total groundfish TALFF plus reserves, and is automatically established by the following equation:

> Nation's Initial Salmon PSC equals Total Salmon PSC multiplied by the Nation's Initial Groundfish Allocation divided by Total Initial Groundfish TALFF plus Reserves.

At the beginning of the fishing year, a portion of the salmon PSC will not be distributed to nations because groundfish reserves will not yet be apportioned and some of the initial TALFF may not yet be allocated. This remaining portion of the salmon PSC shall be subsequently distributed to nations in proportion to increases in their groundfish allocations which result from the apportionment of the initial unallocated TALFF and groundfish reserves.

H. Exceptions to Prohibited Species Management Regime for Pacific Halibut, King Crab, and Tanner Crab

Although a nation's PSC may have been reached, the Regional Director may notify the nation that selected fishing elements of the nations's trawl fleet will be allowed to continue fishing under specified conditions until the nation's groundfish allocation is reached. The Regional Director will take into account the following considerations when making such allowances: (1) the risk of biological harm to prohibited species stocks and of socioeconomic harm to authorized prohibited species users posed by continued trawling by the selected elements; (2) the extent to which the selected elements have avoided incidental prohibited species catches up to that point in the fishing year; (3) the confidence of the Regional Director in the accuracy of the estimates of prohibited species catches by the selected elements up to that point in the fishing year; (4) whether observer coverage of the selected elements is sufficient to assure adherence to the prescribed conditions, and to alert the Regional Director to increases in the elements' prohibited species catch; and (5) the enforcement record of owners and operators of vessels included in the selected elements, and the confidence of the Regional Director that adherence to prescribed conditions can be assured in light of available enforcement resources. Any additional incidental catches of prohibited species by vessels which have been allowed to continue fishing will be considered when establishing future PSC limits.

I. Incentives for PSC Reduction

In making supplemental foreign groundfish allocations during a fishing year, the Council recommends that the Secretary of State, in consultation with the Secretary of Commerce, consider the effort of each nation to fulfill the objective of this section. It is inconsistent with the management objective of this section for any nation to conduct its fishing operations without: (l) an earnest attempt to reduce its catch of prohibited species; and (2) remaining within its PSC limitations. Supplemental allocations should serve to reward a nation for its past performance and should serve as an incentive to continue its operating methods that avoid prohibited species. A nation's effort to comply with PSC regulations is therefore a legitimate and important consideration in making foreign allocations.

In order to arrive at long-term solutions for controlling incidental catch of prohibited species, the foreign groundfish fisheries are encouraged to:

(1) conduct NMFS approved gear experiments which are intended to reduce the incidental catch of prohibited species;
(2) collect detailed information on the characteristics of incidental catches; and
(3) transfer the information and gear technology conducive to reduction of the incidental catch of prohibited species to the U.S. for use by government and industry.

As an incentive for gear research, catches of prohibited species during any research aimed at long-term solutions for controlling incidental catches of prohibited species that are approved by the National Marine Fisheries Service will be exempted from the PSC limits for that nation, for that year. Groundfish catches during the research where the catch is retained for commercial purposes will continue to be counted towards a nation's allocations.

J. Estimation of Prohibited Species Catch

Catches of prohibited species will be estimated from data by U.S. observers and other reported statistics that are considered reliable.

14.5.3 Fishing Area Restrictions

A. General

1. No harvesting year-round within 12 miles of the baseline used to measure the territorial sea, except as specified below.

   Rationale -- To prevent conflicts with U.S. fixed gear and small inshore fishing vessels and to prevent catch of localized inshore species important to U.S. commercial and subsistence fishermen. If joint venture operations are permitted, foreign ships receiving fish from American fishermen may operate to within three miles of the baseline used to measure the territorial sea. However, when operating within the area between 3 and 12 miles of the baseline used to measure the territorial sea, such foreign processors may not receive fish from foreign vessels.

2. The area covered by this FMP (or an individual sub-area where a specific catch limit applies) will be closed to all fishermen of a nation for the remainder of the calendar year when that nation's allocation of any species or species group is exceeded, except that such closures will affect longline fishing only if the national allocation of any of the following species is exceeded: sablefish; Pacific cod; and Greenland turbot.

   Rationale -- To discourage foreign fleets from covertly targetting on a species after the allowed catch for it has been taken.

B. Trawl Fishery

1. Area A -- No trawling year-round in the Bristol Bay Pot Sanctuary (as described in Appendix III and Figure 27b).

   Rationale -- To prevent conflicts between foreign mobile gear and concentrations of U.S. crab pots; to prevent incidental catch of juvenile halibut which are known to concentrate in this area.

2. Crab and Halibut Protection Zone -- No trawling year-round in the Crab and Halibut Protection Zone (as described in Appendix III and Figure 27).

3. Area B -- No trawling from December 1 to May 31 in the Winter Halibut Savings Area (as described in Appendix III and Figure 27b).

   Rationale -- To protect winter concentrations of juvenile halibut, and to protect spawning concentrations of pollock and flounders.

4. Area C -- No trawling year-round in the Longline Sanctuary Area (as described in Appendix III and Figure 27b).

   Rationale -- To provide a sanctuary for foreign and domestic longline fishing in recognition of the situation in which highly developed trawl fisheries in both the Bering Sea/Aleutians area and the Gulf of Alaska have tended to preempt grounds from the traditional longline fishing method.

   (Prior to 1977, no Danish seiners, side trawlers, or pair trawlers operated in this area, and less than one percent of the foreign stern trawl effort occurred in this area. Because of the displacement of the Japanese land-based dragnet fleet from the Soviet 200-mile zone, that fleet has, since 1977, increased its utilization of the trawl grounds surrounding the Aleutian archipelago. As a result, during the first seven months of 1978, of the total foreign stern trawl effort in the Bering Sea/Aleutians region, about 3% occurred in this longline sanctuary area.)

5. Area D -- No trawling January 1 through June 30 in the area known as Petrel Bank (as described in Appendix III and Figure 27b). Trawling is permitted seaward of three nautical miles at other times of the fishing year.

   Rationale -- To avoid gear conflicts during the conduct of the domestic king crab fishery and to avoid the incidental catch of king crab by trawling. Data available from the fishery in the Petrel Bank area indicate a substantial incidental trawl catch of red, blue and golden king crab. The crab savings effected by the trawl closure is a direct benefit to the domestic fleet by preserving harvestable crabs from the rigors of a trawl effort during the soft-shell or molting period.

6. Area E -- No trawling within 12 nautical miles of the baseline used to measure the U.S. territorial sea January 1 - April 30 in Area E (as described in Appendix III and Figure 27b) EXCEPT trawling is permitted seaward of three nautical miles from May 1 - December 31.

   Rationale -- To avoid gear conflicts during the conduct of the domestic king crab fishery and the development of the domestic bottomfish effort and to avoid the adverse effects of the incidental catch of king crabs by trawl.

7. Area F -- Trawling permitted seaward of three nautical miles from the baseline used to measure the U.S. territorial sea in Area F (as described in Appendix III and Figure 27b).

C. Longline Fishery

1. Area B -- Winter Halibut Savings Area (as described in Appendix III and Figure 27b).

(a) December 1 through May 31 -- When the incidental catch of Pacific halibut by all foreign longline vessels in the Bering Sea/Aleutian Islands area reaches 105 mt during the 12-month period from June 1 through May 31, all foreign longline vessels shall be prohibited from fishing landward of the 500 meter isobath for the remainder of the 6-month period December 1 through May 31.

(b) June 1 through November 30 -- no closures.

Rationale -- To allow foreign longline fleets to catch their groundfish allocation and still adequately protect juvenile Pacific halibut which concentrate in the area during winter months.

2. Other Areas -- no closures.

3. Throughout the area west of 170°W, longlining is permitted seaward of three nautical miles from the baseline used to measure the U.S. territorial sea.

D. In-Season Adjustments (Reserved)

1. Inseason adjustments issued by the Secretary under this paragraph include:

(a) The closure, extension, or opening of a season in all or part of a management area.

(b) Modification of the allowable gear to be used in all part of a management area.

(c) The adjustment of TACs or PSC limits.

2. Any inseason adjustment under this paragraph must be based on a determination that such adjustments are necessary to prevent:

(a) The overfishing of any species or stock of fish or shellfish.

(b) The harvest of a TAC for any groundfish species, the taking of a PSC limit for any prohibited species, or the closure of any fishing for groundfish based on a TAC or PSC limit which on the basis of the best available scientific information is found by the Secretary to be incorrectly specified.

3. The selection of the appropriate inseason management adjustments under (1)(a) or (b) of this paragraph must be from the following authorized management measures and be based on a determination by the Regional Director that the management adjustment selected is the least restrictive necessary to achieve the purpose for the adjustment:

(a) Any gear modification that would protect the species in need of conservation protection, but which would allow fisheries to continue.

(b) A time/area closure which would allow fisheries to continue in non-critical areas and time periods.

(c) Closure [or opening] of a management area to all groundfish fishing for the remainder of the fishing year.

4. The adjustment of a TAC or PSC limit for any species under (1)(c) of this paragraph must be based on the best available scientific information concerning the biological stock status of the species in question and on the Regional Director's determination that the currently specified TAC or PSC limit is incorrect. Any adjustment to a TAC or PSC limit must be reasonably related to the change in biological stock status.

14.6 Operational Needs and Costs (1000's dollars)

114 man-months of foreign fishery observer coverage	370[1/]
NWAFC allocation compliance analyses	10
NMFS computerized foreign fishery information systen	36
NMFS Alaska Regional Office Management Division	435
NOAA/Justice administration of penalties	12
800 Coast Guard ship patrol days	2,800
2500 Coast Guard aerial patrol hours	1,900
State of Alaska fishery data collection	11
Total	5,574

14.7 Management Measures to Address Identified Habitat Problems

An FMP may contain only those conservation and management measures which pertain to fishing or to fishing vessels. The Secretary, upon the recommendation of the Council, may adopt regulations of the kinds and for the purposes set forth below.

- Propose regulations establishing gear, timing, or area restrictions for purposes of protecting particular habitats of species in the Bering Sea/Aleutian Island groundfish fishery.
- Propose regulations establishing area or timing restrictions to prevent the harvest of fish in contaminated areas.
- Propose regulations restricting disposal of fishing gear by domestic vessels.

1/ Reimbursed by foreign governments to the U.S. Treasury

15.0 RELATIONSHIP OF RECOMMENDED MANAGEMENT MEASURES TO FCMA NATIONAL STANDARDS AND OTHER APPLICABLE LAWS

This management plan can be considered an extension of the Preliminary Fishery Management Plan (PFMP) for the Bering Sea and Aleutians Trawl Fishery and portions of the PFMP for the Sablefish Setline/Trap Fishery, both prepared and implemented by the Secretary of Commerce, and which are superceded by this plan.

The management regime described in Section 14.0 is considered to be in conformance with the seven national standards set forth in Section 301 of the FCMA.

The U.S. is party to the following international conventions which directly or indirectly address conservation and management needs of groundfish in the Bering Sea/Aleutians region: the International Convention for the High Seas Fisheries of the North Pacific Ocean (INPFC), and the Convention Between the United States of America and Canada for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea (IPHC).

This plan has a most significant relationship to the management of the Pacific halibut fishery which continues to be vested in the International Pacific Halibut Commission. Many of the management measures contained herein are for the expressed purpose of mitigating a severe crisis in the domestic halibut fishery by recognizing a situation in which the trawl fishery (and possibly the sablefish setline fishery) could be a major contributor to declining halibut abundance.

There are no Indian treaty fishing rights for groundfish in the fishery conservation zone in the Bering Sea/Aleutians region.

The Constitution of the State of Alaska states the following in Article XIII:

> Section 2. General Authority. The legislature shall provide for the utilization, development, and conservation of all natural resources belonging to the State, including land and waters, for the maximum benefit of its people.
>
> Section 4. Sustained Yield. Fish, forest, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses.
>
> Section 15. No Exclusive Right of Fishery, has been amended to provide the State the power "to limit entry into any fishery for purposes of resource conservation" and "to prevent economic distress among fishermen and those dependent upon them for a livelihood".

16.0 RESEARCH NEEDS

In deciding which of these research needs are to be addressed, it is important that they be reviewed regularly and ranked in order of importance and likelihood of success.

Research will be required to: (1) find means of improving the accuracy of commercial catch statistics; (2) refine estimates of abundance and biological characteristics of stocks through research resource surveys; (3) improve the capability for predicting changes in resource abundance, composition, and availability; (4) develop means of reducing the incidental catch of non-target species; (5) identify subpopulations; and (6) examine the direct affects of man's activities on fish habitats and ecosystems.

Catches reported by the foreign fishing fleets provide a means of monitoring the progress of the fisheries towards catch quotas. Later these catch statistics are examined with associated fishing effort to compute CPUE, an index of stock abundance. Discrepancies have been found between reported catches by foreign vessel skippers and those estimated by U.S. observers aboard these vessels. Observer's estimates have been generally greater than those reported by the vessel's master, suggesting under-reporting of catches by the foreign fleets. This problem needs to be examined and steps taken to improve the accuracy of reported catch statistics.

Estimates of biomass of specific groundfish resources have been obtained through resource surveys using bottom trawls. For such semi-demersal species as pollock and cod, biomass estimates through research vessel trawl surveys have so far been underestimated because of the lack of knowledge of the portion of the stocks in the water column that lie above the stratum sampled by the trawl. Studies are required to determine the efficiency at which research trawls capture pollock, cod, and other semi-demersal forms in order to improve the accuracy of biomass estimates of these species.

Long-term fisheries management requires reliable forecasting of stock conditions. Until now forecasts have been based mainly on past events, such as trends in abundance indices (CPUEs) and size and age composition of specific resources without any consideration of the interactions of these resources with each other and the environment. Studies need to be continued to determine for predictive purposes those factors that have major influences on the abundance, composition, and distribution of resources, and there is a critical need for annual prerecruit surveys (i.e., of young fish before they enter the fisheries) so that a measure of their abundance can be used to forecast later contributions to the exploitable stock.

For purposes of conservation and harvesting efficiency, fishing gear should be modified or developed which will reduce the bycatch of halibut, crabs, and other important species in the trawl fisheries. Although these species are immediately returned to the sea after capture, they still suffer an added source of mortality from their capture and handling.

Within the eastern Bering Sea/Aleutians region there undoubtedly exist subpopulations of species that, because of their unique biological features (e.g. growth and mortality) should be managed as separate stocks. Research, therefore, is required to provide a firm basis for the identification and delineation of specific stock units.

The paucity of specific information concerning sablefish, Pacific ocean perch, Atka mackerel, arrowtooth flounder, and Greenland turbot has required an empirical approach to management. Although some information on these species has recently been gathered by U.S. observers aboard foreign fishing vessels and from foreign fisheries statistics, direct assessment of abundance and stock condition has not been accomplished. In the past, surveys have essentially been restricted to the

Continental Shelf of the eastern Bering Sea with very little effort directed to the Continental Slope where these and other species are know to concentrate. No assessment surveys have been conducted in the Aleutians region where important stocks of Pacific ocean perch, sablefish, and Atka mackerel occur. Geographic and bathymetric extensions of research surveys to these areas should be considered.

The several squids which are present in the region form another resource for which very little information is available. The squid fishery is presently of small magnitude but, because of intuitive indications of very large abundances, exploitation is expected to increase substantially. If the sustainable potential of this resource is to be realized, basic taxonomic, distributional, biological, and abundance studies will soon have to be initiated.

Research needs related to maintaining the productive capacity of fish habitat can be broadly classified as those which (a) examine the direct affects of man's activities (such as fishing, oil exploration, or coastal development), and (b) apply fisheries oceanography in an ecosystem context (such as migration and transport patterns, predator/prey relationships, life histories). Both categories of research serve to increase the understanding of natural systems and the ability to detect and measure change caused by natural or man-made forces. The following represents areas that are potential cause for concern, and where precaution is warranted.

Under category (a), further research should be conducted on the short and long-term effects of habitat alteration caused by fishing and oil exploration in the Bering Sea/Aleutian Island groundfish management area. These include the effects of derelict fishing gear, pollution products, the recovery rate of oil-polluted environments, and long-term cumulative effects of discharged and spilled oil.

Under category (b), expanded research is needed on factors affecting the ecosystem such as currents, temperatures, ocean productivity and food chains, and the influence of climatic variation on biological and physical events. More information about life histories, habitat requirements, and predator/prey relationships is needed for a clearer understanding of an organism's response to perturbations in the habitat.

Finally, but in the long run most importantly, the complex ecosystem will have to be accurately modelled so that bio-environmental processes can be understood and inter-species--including birds and marine mammals--relationships can be quantified and relied upon in determining optimum yields.

17.0 STATEMENT OF COUNCIL INTENTIONS TO REVIEW THE PLAN AFTER APPROVAL BY THE SECRETARY OF COMMERCE

The North Pacific Fishery Management Council will, after approval and implementation of this plan by the Secretary, maintain a continuing review of the fisheries managed under this plan through the following methods:

1. Maintain close liaison with the management agencies involved, usually the Alaska Department of Fish and Game and the National Marine Fisheries Service, to monitor the development of the fisheries and the activity in the fisheries.

2. Promote research to increase their knowledge of the fishery and the resource, either through Council funding or by recommending research projects to other agencies.

3. Conduct public hearings at appropriate times and in appropriate locations, usually at the close of a fishing season and in those areas where a fishery is concentrated, to hear testimony on the effectiveness of the management plans and requests for changes.

4. Consideration of all information gained from the above activities and development if necessary, of amendments to the management plan. The Council will also hold public hearings on proposed amendments prior to forwarding them to the Secretary for possible adoption.

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19.0 APPENDICES

Appendix I	--	Sample Community Profile
Appendix II	--	Pollock Cohort Analyses
Appendix III	--	Description of Closed Areas
Appendix IV	--	Programs Addressing Habitat of Bering Sea/Aleutian Islands Groundfish Stocks

APPENDIX I. Aleutian Subregion Community Profile (Ref. Sec. 8.5)

Water. Settled areas in the subregion are accessible only by air or water transport. Even these modes are severely limited by weather conditions. Communities are small and far apart, making the feasibility of waterborne commercial transportation systems marginal.

Passenger service by water is limited. The Alaska Marine Highwasy does not serve this area. Residents wishing to travel by water depend primarily on unscheduled service provided by fishing boats. A Dutch Harbor resident provides scheduled passenger and freight service with the M/V ISLANDER between Amaknak and Unalaska Islands and is considering expanding to a ferry system serving Umnak, Unalaska, Amaknak, Akutan, and Akun Islands.

Deep water occurs along the south shores of the Aleutian Islands. Unimak Pass is the most frequently used passage between the North Pacific and Bering Sea. Although sheltered harbors and coves capable of handling deep-draft vessels occur frequently throughout the Chain, improved harbor facilities are few.

Monthly waterborne freight service is provided from Seattle to Captains Bay on Unalaska Island, to Unalaska and to Adak, service to Sand Point and Dutch Harbor is twice monthly. The vessel carries containerized cargo, some of which comes from Anchorage. Atka has no airport but is served monthly by a tug from Adak Naval Station. Attu and Shemya receive the major portion of their supplies annually through a military-contracted private operation. The M/V PRIBILOF, operated by the Aleutian Pribilof Island Association, provides waterborne freight service to St. Paul and St. George, Privilof Islands, and the M/V North Star III, operated by the Bureau of Indian Affairs, services certain communities on an annual basis.

Air. The Cold Bay International Airport, constructed by the U.S. Army Corps of Engineers in the early 1940's, is a major transportation hub for the Aleutian Chain and a key refueling station for trans-Pacific flights between the Far East and the continental United States. Flight time through Cold Bay is an hour or more shorter to the San Francisco and Los Angeles area than by way of Anchorage, Sixteen major air carriers or charter airlines used this airport during the past two years.

Many smaller air taxi services and charter airlines use the Cold Bay Airport and, while the volume is not great, the service to the people in the area is most significant.

Local service is available by Reeve Aleutian Airways serving the Alaska Peninsula, the Aleutian Chain, and St. Paul in the Pribilof Islands. This airline provides access to all military sites and many of the smaller communities. Although St. George Island in the Pribilofs lacks facilities for handling large commercial aircraft, National Marine Fisheries has inaugurated a charter service from King Salmon and Dillingham to St. George approximately once a week.

Land. With the minor exception of a few local roads within the communities, no highway system exists in the Aleutian Subregion.

APPENDIX II. Pollock Cohort Analyses (Ref. Section 10.4)

Cohort analyses which show growth and decay of a pollock biomass under different instantaneous rates of natural mortality (Tables A-G).

Table A. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .350 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	344	15	5.6	.0	344	15	5.7	.0	344	15	5.7	.0
2	1047	47	9.3	.2	1051	46	9.3	.2	1049	46	9.3	.2
3	1711	77	12.4	.5	1731	76	12.5	.5	1721	76	12.4	.5
4	2114	95	15.0	.9	2154	94	15.1	.9	2134	94	15.1	.9
5	2231	100	17.2	1.3	2286	100	17.3	1.3	2258	100	17.3	1.3
6	2129	95	19.1	1.7	2193	96	19.2	1.8	2161	96	19.2	1.8
7	1897	85	20.7	2.2	1962	86	20.9	2.3	1930	85	20.8	2.2
8	1609	72	22.1	2.6	1670	73	22.2	2.7	1639	73	22.2	2.7
9	1315	59	23.3	3.1	1369	60	23.4	3.2	1342	59	23.3	3.1
10	1045	47	24.2	3.5	1091	48	24.4	3.6	1068	47	24.3	3.5
11	812	36	25.1	3.8	850	37	25.2	4.0	831	37	25.2	3.9
12	620	28	25.8	4.1	651	28	26.0	4.3	636	28	25.9	4.2
13	467	21	26.4	4.4	491	21	26.6	4.6	479	21	26.5	4.5
14	348	16	26.9	4.7	366	16	27.1	4.9	357	16	27.0	4.8
15	257	12	27.3	4.9	271	12	27.5	5.2	264	12	27.4	5.0
16	188	8	27.7	5.1	199	9	27.9	5.4	193	9	27.8	5.2

tbleA.bsa gp/fmps

Table B. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .375 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	336	17	5.6	.0	336	17	5.7	.0	336	17	5.7	.0
2	996	51	9.3	.2	1000	50	9.3	.2	998	50	9.3	.2
3	1587	81	12.4	.5	1606	80	12.5	.5	1596	80	12.4	.5
4	1913	97	15.0	.9	1949	97	15.1	.9	1931	97	15.1	.9
5	1969	100	17.2	1.3	2017	100	17.3	1.3	1993	100	17.3	1.3
6	1833	93	19.1	1.7	1887	94	19.2	1.8	1860	93	19.2	1.8
7	1593	81	20.7	2.2	1647	82	20.9	2.3	1620	81	20.8	2.2
8	1317	67	22.1	2.6	1367	68	22.2	2.7	1342	67	22.2	2.7
9	1050	53	23.3	3.1	1093	54	23.4	3.2	1072	54	23.3	3.1
10	814	41	24.2	3.5	850	42	24.4	3.6	832	42	24.3	3.5
11	617	31	25.1	3.8	646	32	25.2	4.0	631	32	25.2	3.9
12	460	23	25.8	4.1	482	24	26.0	4.3	471	24	25.9	4.2
13	338	17	26.4	4.4	355	18	26.6	4.6	346	17	26.5	4.5
14	245	12	26.9	4.7	258	13	27.1	4.9	252	13	27.0	4.8
15	177	9	27.3	4.9	186	9	27.5	5.2	181	9	27.4	5.0
16	126	6	27.7	5.1	133	7	27.9	5.4	130	7	27.8	5.2

Table C. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .400 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	328	19	5.6	.0	327	18	5.7	.0	327	19	5.7	.0
2	947	55	9.3	.2	951	53	9.3	.2	949	54	9.3	.2
3	1472	85	12.4	.5	1490	84	12.5	.5	1481	84	12.4	.5
4	1731	100	15.0	.9	1763	99	15.1	.9	1747	99	15.1	.9
5	1737	100	17.2	1.3	1780	100	17.3	1.3	1759	100	17.3	1.3
6	1577	91	19.1	1.7	1624	91	19.2	1.8	1601	91	19.2	1.8
7	1337	77	20.7	2.2	1383	78	20.9	2.3	1360	77	20.8	2.2
8	1079	62	22.1	2.6	1119	63	22.2	2.7	1099	62	22.2	2.7
9	839	48	23.3	3.1	873	49	23.4	3.2	856	49	23.3	3.1
10	634	36	24.2	3.5	662	37	24.4	3.6	648	37	24.3	3.5
11	469	27	25.1	3.8	490	28	25.2	4.0	480	27	25.2	3.9
12	341	20	25.8	4.1	357	20	26.0	4.3	349	20	25.9	4.2
13	244	14	26.4	4.4	256	14	26.6	4.6	250	14	26.5	4.5
14	173	10	26.9	4.7	182	10	27.1	4.9	177	10	27.0	4.8
15	121	7	27.3	4.9	128	7	27.5	5.2	125	7	27.4	5.0
16	85	5	27.7	5.1	89	5	27.9	5.4	87	5	27.8	5.2

Table D. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .430 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	318	21	5.6	.0	318	20	5.7	.0	318	21	5.7	.0
2	892	58	9.3	.2	896	57	9.3	.2	894	58	9.3	.2
3	1346	88	12.4	.5	1362	87	12.5	.5	1354	87	12.4	.5
4	1535	100	15.0	.9	1564	100	15.1	.9	1549	100	15.1	.9
5	1495	97	17.2	1.3	1532	98	17.3	1.3	1514	98	17.3	1.3
6	1318	86	19.1	1.7	1357	87	19.2	1.8	1337	86	19.2	1.8
7	1084	71	20.7	2.2	1121	72	20.9	2.3	1102	71	20.8	2.2
8	848	55	22.1	2.6	881	56	22.2	2.7	864	56	22.2	2.7
9	640	42	23.3	3.1	666	43	23.4	3.2	653	42	23.3	3.1
10	470	31	24.2	3.5	490	31	24.4	3.6	480	31	24.3	3.5
11	337	22	25.1	3.8	353	23	25.2	4.0	345	22	25.2	3.9
12	238	15	25.8	4.1	249	16	26.0	4.3	243	16	25.9	4.2
13	165	11	26.4	4.4	174	11	26.6	4.6	169	11	26.5	4.5
14	114	7	26.9	4.7	120	8	27.1	4.9	117	8	27.0	4.8
15	77	5	27.3	4.9	82	5	27.5	5.2	79	5	27.4	5.0
16	52	3	27.7	5.1	55	4	27.9	5.4	54	3	27.8	5.2

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Table E. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .450 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	312	22	5.6	.0	311	22	5.7	.0	311	22	5.7	.0
2	857	60	9.3	.2	861	60	9.3	.2	859	60	9.3	.2
3	1267	89	12.4	.5	1282	89	12.5	.5	1275	89	12.4	.5
4	1417	100	15.0	.9	1444	100	15.1	.9	1430	100	15.1	.9
5	1353	95	17.2	1.3	1386	96	17.3	1.3	1370	96	17.3	1.3
6	1169	82	19.1	1.7	1203	83	19.2	1.8	1186	83	19.2	1.8
7	942	66	20.7	2.2	974	67	20.9	2.3	958	67	20.8	2.2
8	723	51	22.1	2.6	750	52	22.2	2.7	737	52	22.2	2.7
9	535	38	23.3	3.1	557	39	23.4	3.2	546	38	23.3	3.1
10	384	27	24.2	3.5	401	28	24.4	3.6	393	27	24.3	3.5
11	270	19	25.1	3.8	283	20	25.2	4.0	277	19	25.2	3.9
12	187	13	25.8	4.1	196	14	26.0	4.3	191	13	25.9	4.2
13	127	9	26.4	4.4	134	9	26.6	4.6	131	9	26.5	4.5
14	86	6	26.9	4.7	90	6	27.1	4.9	88	6	27.0	4.8
15	57	4	27.3	4.9	60	4	27.5	5.2	59	4	27.4	5.0
16	38	3	27.7	5.1	40	3	27.9	5.4	39	3	27.8	5.2

Table F. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .500 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	297	26	5.6	.0	296	25	5.7	.0	296	25	5.7	.0
2	776	67	9.3	.2	779	66	9.3	.2	777	66	9.3	.2
3	1091	94	12.4	.5	1104	93	12.5	.5	1097	94	12.4	.5
4	1160	100	15.0	.9	1182	100	15.1	.9	1171	100	15.1	.9
5	1054	91	17.2	1.3	1080	91	17.3	1.3	1067	91	17.3	1.3
6	866	75	19.1	1.7	891	75	19.2	1.8	879	75	19.2	1.8
7	664	57	20.7	2.2	687	58	20.9	2.3	675	58	20.8	2.2
8	485	42	22.1	2.6	503	43	22.2	2.7	494	42	22.2	2.7
9	341	29	23.3	3.1	355	30	23.4	3.2	348	30	23.3	3.1
10	233	20	24.2	3.5	243	21	24.4	3.6	238	20	24.3	3.5
11	156	13	25.1	3.8	163	14	25.2	4.0	160	14	25.2	3.9
12	103	9	25.8	4.1	108	9	26.0	4.3	105	9	25.9	4.2
13	66	6	26.4	4.4	70	6	26.6	4.6	68	6	26.5	4.5
14	43	4	26.9	4.7	45	4	27.1	4.9	44	4	27.0	4.8
15	27	2	27.3	4.9	29	2	27.5	5.2	28	2	27.4	5.0
16	17	1	27.7	5.1	18	2	27.9	5.4	18	1	27.8	5.2

Table G. Cohort analysis to determine the growth and decay of a pollock cohort starting with 10,000 individuals and assuming .600 natural mortality rate.

Age	Female Population				Male Population				Combined Sexes			
	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of max Biomass	Length (in)	Weight (lb)	Biomass (lb)	Percent of Max Biomass	Length (in)	Weight (lb)
1	268	33	5.6	.0	268	33	5.7	.0	268	33	5.7	.0
2	635	79	9.3	.2	638	78	9.3	.2	636	78	9.3	.2
3	808	100	12.4	.5	818	100	12.5	.5	813	100	12.4	.5
4	778	96	15.0	.9	792	97	15.1	.9	785	97	15.1	.9
5	639	79	17.2	1.3	655	80	17.3	1.3	647	80	17.3	1.3
6	475	59	19.1	1.7	489	60	19.2	1.8	482	59	19.2	1.8
7	330	41	20.7	2.2	341	42	20.9	2.3	350	41	20.8	2.2
8	218	27	22.1	2.6	226	28	22.2	2.7	222	27	22.2	2.7
9	139	17	23.3	3.1	144	18	23.4	3.2	141	17	23.3	3.1
10	86	11	24.2	3.5	90	11	24.4	3.6	88	11	24.3	3.5
11	52	6	25.1	3.8	54	7	25.2	4.0	53	7	25.2	3.9
12	31	4	25.8	4.1	32	4	26.0	4.3	32	4	25.9	4.2
13	18	2	26.4	4.4	19	2	26.6	4.6	19	2	26.5	4.5
14	11	1	26.9	4.7	11	1	27.1	4.9	11	1	27.0	4.8
15	6	1	27.3	4.9	6	1	27.5	5.2	6	1	27.4	5.0
16	3	0	27.7	5.1	4	0	27.9	5.4	4	0	27.8	5.2

APPENDIX III. Descriptions of Closed Areas

1. Specific regulation areas opened or closed to fishing during certain times of the year for some fishing vessels are shown in Figure 27 and defined as follows:

Area A -- Bristol Bay Pot Sanctuary

The portion of the Fishery Conservation Zone encompassed by straight lines connecting the following points, in the order listed:

Cape Sarichef Light (54°36'N - 164°55'42"W)
55°16'N - 166°10'W
56°20'N - 163°00'W
57°10'N - 163°00'W
58°10'N - 160°00'W
Intersection of 160°00'W with the Alaska Peninsula

Area B -- Winter Halibut-savings Area

That portion of the Fishery Conservation Zone encompassed by straight lines connecting the following points, in the order listed:

Cape Sarichef Light (54°36'N - 164°55'42"W)
52°48'N - 170°00'W
55°30'N - 170°00'W
55°30'N - 166°47'W
56°00'N - 167°45'W
56°00'N - 166°00'W
56°30'N - 166°00'W
56°30'N - 163°00'W
56°20'N - 163°00'W
55°16'N - 166°10'W
Cape Sarichef Light (54°36'N - 164°55'42"W)

Area C -- The area between 172-00'W and 178-30'W within the FCZ south of a line drawn to connect the following coordinates:

53°14'N - 172°00'W
52°13'N - 176°00'W
52°00'N - 178°00'W
52°00'N - 178°30'W

Area D -- The area known as Petrel Bank is bordered by straight lines connecting the following coordinates in the order listed:

52°51'N - 178°30'W
52°51'N - 179°00'E
51°15'N - 179°00'E
51°15'N - 178°30'W
52°51'N - 178°30'W

Area E -- The area west of 178°30'W but excluding Area D, known as Petrel Bank that is defined above.

Area F -- The area between three and twelve nautical miles from the baseline used to measure the U.S. territorial sea bounded by 170°30'W and 172°00'W on the north side of the Aleutian Islands and by 170°00'W and 172°00'W on the south side of the Aleutians.

2. Fishing areas governed by this Fishery Management Plan and shown in Figure 26a are defined as follows:

Area I -- The area of the Fishery Conservation Zone (FCZ) north of the Aleutian Islands and east of 170°W longitude.

Area II -- The area of the FCZ north of 55°N latitude and between 170°W longitude and 180° longitude.

Area III -- The area of the FCZ north of 55°N latitude and west of 180° longitude.

Area IV -- The area of the FCZ west of 170°W longitude and south of 55°N latitude.

3. The Salmon Savings Area shown in Figure 28 is defined as follows:

Fishing Area II and that portion of Fishing Area I lying between 55°N and 57°N latitude and 165°W and 170°W longitude.

4. Bycatch Limitation Zones 1 and 2 (Zones 1 and 2) shown in Figure 27a are defined as follows:

Zone 1 is that area bounded by 165°W longitude and 58°N latitude extending east to the shore.

Zone 2 is that area bounded by 165°W longitude, north to 58°N, then west to the intersection of 58°N. and 171°W. longitude, then north to 60°N., then west to 179°20'W. longitude, then south to 59°25'N. latitude, then diagonally extending on a straight line southeast to the intersection of 167°W longitude and 54°30'N latitude, and then extending eastward along 54°30'N latitude to 165°W. longitude.

5. For the periods January 1 - March 14 and June 16 - December 31 of each fishing year the Crab and Halibut Protection Zone is defined as that portion of the EEZ north of the Alaska Peninsula, south of 58°N latitude, west of 160°W longitude and east of 162°W longitude. For the period March 15 -June 15 of each fishing year the Crab and Halibut Protection Zone is defined as that portion of the EEZ north of the Alaska Peninsula, south 58°N latitude, west of 160°W longitude and east of 163°W longitude (Figure 27a).

6. The Halibut Protection Zone (Zone 2H) is that portion of Zone 2 south 56° 30'N latitude, west of 165°W longitude and east of 170°W longitude.

APPENDIX IV. Programs Addressing Habitat of Bering Sea/Aleutian Islands Groundfish Stocks

A. 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 by the Council and NMFS within the Bering Sea/Aleutian Island area for the same purpose.

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 inter-agency 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 review is required or encouraged. In some cases, State agencies may share the Federal responsibility.

* (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, decision-making 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.

* (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.

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 of proposed lease sales, 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.

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 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.

* (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 Department 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.

* (m) Marine Mammal Protection Act (MMPA). The Marine Mammal Protection Act establishes a moratorium on the taking of marine mammals and a ban on the importation of marine mammal products with certain exceptions. Responsibility is divided between DOC (whales, porpoises, seals, and sea lions) and DOI (other marine mammals) to issue permits and to waive the moratorium for specified purposes, including incidental takings during commercial fishing operations. The Magnuson Act amended the MMPA to extend its jurisdiction to the FCZ. If the FMP has effect on marine mammal populations, certain information must be included in the EIS, and the FMP should indicate whether permits are available for any incidental takings.

2. Specific actions taken by the Council and NMFS related to habitat for the 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) 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 percent 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.

(c) 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 counter-measure 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 the Interior.

B. Non-regulatory techniques to address identified habitat problems.

The following is a list of "real time" possible non-regulatory 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 Appendix IV-A, above. Possible regulatory actions may be found in section 14.7.

- Hold hearings to gather information or opinions about specific proposed projects having a potentially adverse affect on habitats of species in 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.

- 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 habitat against loss or degradation.

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

ANNEX I -- Content of Stock Assessment and Fishery Evaluation Report

Stock Assessment and Fishery Evaluations (SAFEs) will be prepared annually by the Council's plan maintenance team (PMT) with the assistance of the NMFS Northwest and Alaska Fisheries Center, other agencies, or other scientists noted for their expertise in groundfish biology. The SAFE will provide the biological information base necessary to manage groundfish stocks under a multi-species ecosystem management regime.

The SAFE will provide information on the historical catch trend, estimates of the MSY of the groundfish complex as well as its component species groups, assessments on the stock condition of individual species groups; assessments of the impacts on the ecosystem of harvesting the groundfish complex at the current levels given the assessed condition of stocks, including consideration of rebuilding depressed stocks; and alternative harvest strategies and related effects on the component species groups.

Current estimates of individual species' and species groups' ABC and MSY can be found in Bakkala, et al., 1989. These estimates are updated annually as part of the stock assessments prepared by the National Marine Fisheries Service for the annual meeting of the International North Pacific Fisheries Commission.

The SAFE will annually update the biological information base necessary for multispecies management. It will also provide readers and reviewers with knowledge of the factual basis for TAC decisions, and illustrate the manner in which new data and analyses are used to obtain individual species groups' estimates of ABC and MSY.

Copies of the most recent SAFE are available from the North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, Alaska, 99510.

ANNEX II -- Derivation of Total Allowable Level of Foreign Fishing (TALFF)

The initial TALFF for each target species and for the "other species" category will be determined annually by the following equation:

$$TALFF = TAC - (DAH + Reserves)$$

The final TALFF for each target species and the "other species" category will equal the initial TALFF plus any Reserves or Unneeded DAH which are reallocated to TALFF during the fishing year as explained in Section 11.4

ANNEX III -- Catch Statistics of the Bering Sea/Aleutian Groundfish Fishery

Table A	All nation catches in the Bering Sea/Aleutian Region, by major species groups for the last 10 years of record.
Table B	Detailed statistics of the foreign fisheries in the Aleutians area, 1962-77.
Table C	Detailed statistics of the foreign fisheries in the eastern Bering Sea, 1954-77.

ANNEX IIIA--All-nation catches in the Bering Sea/Aleutian Region, by major species groups, for the last 10 years of record (1000's mt)1/.

Species/	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978 2/
Pollock	702	863	1,257	1,744	1,875	1,759	1,588	1,357	1,238	888.2	921.3
Pacific cod	63.7	53.3	74.6	50.5	47.0	58.6	67.0	55.1	57.8	36.5	37.3
Pacific ocean perch	76.4	53.3	76.8	31.6	38.9	15.5	36.5	25.2	32.6	10.8	7.4
Sablefish	20.5	20.4	13.8	18.0	19.0	10.6	7.7	5.0	8.2	4.6	1.6
Halibut	7.1	6.3	7.7	8.6	5.9	4.3	2.2	1.6	1.2	0.6	4/
Flounders	149.9	236.2	234.9	323.4	237.7	207.1	196.3	200.4	187.2	121.9	208.3
Atka mackerel	3/	3/	1.0	3/	4.7	1.7	1.4	13.3	20.7	21.0	22.4
Others	31.5	14.4	25.9	41.5	134.7	62.3	79.9	61.9	45.6	57.3	73.9
All species	1,051.1	1,247.1	1,691.7	2,216.6	2,362.9	2,119.1	1,979.0	1,719.5	1,591.3	1,140.9	1,272.2

1/ Values in this table may differ slightly from those used elsewhere in this document because of differences in apportioning between species not clearly listed in foreign statistical reports or differences in treating estimates based on U.S. surveillance when catches were not reported.
2/ Preliminary.
3/ Catch, if any, included under "Others".
4/ Unknown at this time

ANNEX IIIB

--Foreign catches of groundfish in the Aleutian Island region (170°W to 170°E) by calendar year, 1962-76.[1/][2/] (mt)

Species	Nation	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976[3/]
Pollock	Japan	6	1,359	543	663	1,102	1,359	2,680	512	178	624	571	848	1,318	1,519	551
	USSR	--	--	--	--	--	--	--	726	9,490	2,535	866	9,628	21,346	12,262	3,673
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	344
	TOTAL	6	1,359	543	633	1,102	1,359	2,680	1,238	9,668	3,159	1,437	10,476	22,664	13,781	4,568
Pacific cod	Japan	26	601	241	451	154	274	289	220	283	425	435	566	1,334	2,581	3,475
	USSR	--	--	--	--	--	--	--	--	--	1,653	--	411	45	257	312
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	16
	TOTAL	26	601	241	451	154	274	289	220	283	2,078	435	977	1,379	2,838	3,803
Pacific ocean perch and other rockfish	Japan	214	7,636	29,377	38,204	28,733	10,285	23,889	15,641	14,173	14,809	8,789	9,793	22,317	9,528	9,808
	USSR	--	20,000	61,000	71,000	57,700	45,720	26,584	23,172	53,274	7,190	24,595	3,017	824	8,147	6,951
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	33
	TOTAL	214	27,636	90,377	109,204	86,433	56,005	50,473	38,813	64,447	21,999	33,384	12,810	23,141	17,675	16,792
Blackcod	Japan	--	639	1,496	1,224	1,321	1,608	1,676	1,667	1,246	2,700	3,308	2,690	2,451	1,624	1,424
	USSR	--	--	--	--	--	--	--	--	--	170	269	162	14	79	61
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	71
	TOTAL	--	639	1,496	1,224	1,321	1,608	1,676	1,667	1,246	2,870	3,577	2,852	2,465	1,703	1,556
Atka mackerel	Japan	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	USSR	--	--	--	--	--	--	--	--	--	--	4,515	1,604	1,377	12,078	20,092
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
	TOTAL	--	--	--	--	--	--	--	--	--	--	4,515	1,604	1,377	12,078	20,092
Yellowfin sole	Japan	--	2	61	92	98	18	6	20	9	1	--	--	--	--	15
	USSR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
	TOTAL	--	2	61	92	98	18	6	20	9	1	--	--	--	--	15
Rock sole	Japan	--	27	152	147	82	25	17	2	2	1	5	2	36	3	21
	USSR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
	TOTAL	--	27	152	147	82	25	17	2	2	1	5	2	36	3	21
Flathead sole	Japan	--	14	43	128	25	32	186	2	11	16	4	24	41	1	8
	USSR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
	TOTAL	--	14	43	128	25	32	186	2	11	16	4	24	41	1	8
Alaska plaice	Japan	--	--	45	41	--	--	--	--	--	--	--	--	--	--	--
	USSR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
	TOTAL	--	--	45	41	--	--	--	--	--	--	--	--	--	--	--
Halibut	Japan	1	67	681	1,268	163	215	333	331	350	387	357	245	363	145	15
	USSR	--	--	--	--	--	--	--	--	--	--	1	4	4	3	[illegible]
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
	TOTAL	1	67	681	1,268	163	215	333	331	350	387	358	249	367	148	1
Arrowtooth flounder	Japan									274	581	1,323	3,705	3,195	784	5
	USSR									--	--	--	--	--	--	1,28
	ROK	CATCHES OF ARROWTOOTH FLOUNDER AND GREENLAND TURBOT COMBINED UNTIL 1970								--	--	--	--	--	--	--
	TOTAL									274	581	1,323	3,705	3,195	784	1,35
Greenland turbot	Japan	--	7	504	300	63	394	213	228	285	1,750	12,874	8,666	8,788	2,970	1,11
	USSR	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	--
		--	7	504	300	63	394	213	228	285	1,750	12,874	8,666	8,788	2,970	1,23
Other groundfish	Japan	--	513	66	768	131	563	318	2,361	1,181	2,753	3,028	2,630	7,998	8,110	5,63
	USSR	--	--	--	--	--	7,979	8,630	727	9,490	220	19,419	1,614	1,726	178	32
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	24
	TOTAL	--	513	66	768	131	8,542	8,948	3,088	10,671	2,973	22,447	4,244	9,724	8,288	6,19
All groundfish total	Japan	247	10,865	33,209	43,286	31,872	14,773	29,607	20,984	17,992	24,047	30,694	29,169	47,841	27,265	22,11
	USSR	--	20,000	61,000	71,000	57,700	53,699	35,214	24,625	72,254	11,768	49,665	16,440	25,336	33,004	32,81
	ROK	0	0	0	0	0	--	--	--	--	--	--	--	--	--	71
All nations total		247	30,865	94,209	114,286	89,572	68,472	64,821	45,609	90,246	35,815	80,359	45,609	73,177	60,269	55,6

1/ Catch statistics up to 1963 from Forrester et al. 1974 and for 1964-76 from data on file, Northwest and Alaska Fisheries Center, with the following exceptions: Pacific ocean perch and other rockfish - USSR catches for 1963-66 from Chikuni 1975; all flounders except halibut - all national catches, 1963-75 from Wakabayashi and Bakkala 1977.

2/ 0 indicates no fishing, -- indicates fishing, but no catch reported.

3/ Japanese catches for November and December 1976 not included; 1976 catches of flounders (except halibut) by USSR and ROK prorated to species based on species composition in Japanese catch.

ANNEX IIIB (cont'd)

Foreign catches of groundfish in the Aleutian Island region (170°W to 170°E by calendar year, 1976-77. 1/ 2/

Species	Nation	1976	1977 3/
Pollock	Japan	1,015	5,870
	USSR	3,673	1,619
	ROK	344	325
	ROC	0	15
	Total	5,032	7,829
Pacific cod	Japan	3,862	3,162
	USSR	312	100
	ROK	16	-
	ROC	0	-
	Total	4,190	3,262
Pacific ocean perch and other rockfish	Japan	11,204	12,708
	USSR	6,951	786
	ROK	33	87
	ROC	0	2
	Total	18,188	13,583
Blackcod	Japan	1,569	1,768
	USSR	61	-
	ROK	71	86
	ROC	0	-
	Total	1,701	1,854
Atka mackerel	Japan	5	585
	USSR	20,092	20,971
	ROK	-	-
	ROC	0	-
	Total	20,097	21,556
Yellowfin sole	Japan	14	100
	USSR	110	-
	ROK	-	-
	ROC	0	-
	Total	124	100
Rock sole	Japan	23	75
	USSR	71	3
	ROK	-	-
	ROC	0	-
	Total	94	78

ANNEX IIIB (cont'd)

Flathead sole	Japan	7	37
	USSR	55	1
	ROK	-	-
	ROC	0	-
	Total	62	38
Alaska plaice	Japan	-	-
	USSR	-	-
	ROK	-	-
	ROC	0	-
	Total	-	-
Pacific halibut	Japan	15	1
	USSR	2	-
	ROK	-	-
	ROC	0	-
	Total	17	1
Arrowtooth flounder	Japan	1,375	2,297
	USSR	-	9
	ROK	5	-
	ROC	0	1
	Total	1,380	2,307
Greenland turbot	Japan	1,953	2,981
	USSR	112	57
	ROK	6	-
	ROC	0	3
	Total	2,071	3,041
Other groundfish	Japan	5,410	10,723
	USSR	326	4,661
	ROK	241	-
	ROC	0	-
	Total	5,977	15,384
All groundfish total	Japan	26,452	40,307
	USSR	31,765	28,207
	ROK	716	498
	ROC	0	21
All nation total		58,933	69,033

ANNEX IIIC--Foreign catches of groundfish in the eastern Bering Sea (east of 180°) by calendar year, 1954-76.1/ 2/ (mt)

Species	Nation	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Pollock	Japan	—	—	—	—	6,924	32,793	26,097	24,216	58,765	103,353	171,957	229,275
	USSR	0	0	0	0	—	—	—	—	—	—	—	—
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	6,924	32,793	26,097	24,216	58,765	103,353	171,957	229,275
Pacific cod	Japan	—	—	—	—	171	2,864	5,679	2,448	6,054	3,879	13,408	14,722
	USSR	0	0	0	0	—	—	—	—	—	—	—	—
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	171	2,864	5,679	2,448	6,054	3,879	13,408	14,722
Pac. ocean perch and other rockfish	Japan	—	—	—	—	—	—	1,100	13,000	12,900	17,500	13,588	8,723
	USSR	0	0	0	0	—	—	5,000	34,000	7,000	7,000	7,000	9,000
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	—	—	6,100	47,000	19,900	24,500	20,588	17,723
Blackcod	Japan	—	—	—	—	32	393	1,861	26,183	28,521	18,404	6,165	5,001
	USSR	0	0	0	0	—	—	—	—	—	—	—	—
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	32	393	1,861	26,183	28,521	18,404	6,165	5,001
Yellowfin sole	Japan	12,562	14,690	24,697	24,145	39,153	123,121	360,103	399,542	281,103	20,504	48,880	26,039
	USSR	0	0	0	0	5,000	62,200	96,000	154,200	139,600	65,306	62,297	27,771
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	12,562	14,690	24,697	24,145	44,153	185,321	456,103	553,742	420,703	85,810	111,177	53,810
Rock sole	Japan	—	—	—	—	—	—	—	—	—	1,196	1,432	1,780
	USSR	0	0	0	0	—	—	—	—	—	3,806	1,806	1,898
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	—	—	—	—	—	5,002	3,238	3,678
Flathead sole	Japan	—	—	—	—	—	—	—	—	—	7,079	11,121	3,287
	USSR	0	0	0	0	—	—	—	—	—	22,546	14,167	3,426
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	—	—	—	—	—	29,625	25,288	6,713
Alaska plaice	Japan	—	—	—	—	—	—	—	—	—	233	808	474
	USSR	0	0	0	0	—	—	—	—	—	742	1,030	505
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	—	—	—	—	—	975	1,838	979
Pacific halibut	Japan	—	—	—	—	196	674	6,931	3,480	7,865	7,452	1,271	1,369
	USSR	0	0	0	0	—	—	—	—	—	—	—	—
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	196	674	6,931	3,480	7,865	7,452	1,271	1,369
Arrowtooth flounder	Japan	---Catches of arrowtooth flounder and Greenland turbot combined until 1970---											
	USSR												
	ROK												
	TOTAL												
Greenland turbot	Japan	—	—	—	—	—	—	36,843	57,348	58,226	31,565	33,729	7,947
	USSR	0	0	0	0	—	—	—	—	—	—	—	1,800
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	—	—	36,843	57,348	58,226	31,565	33,729	9,747
Other groundfish	Japan	—	—	—	—	147	380	10,260	554	5,931	1,102	736	2,218
	USSR	0	0	0	0	—	—	—	—	—	—	—	—
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL	—	—	—	—	147	380	10,260	554	5,931	1,102	736	2,218
All groundfish total	Japan	12,562	14,690	24,697	24,145	46,623	160,225	448,874	526,771	459,365	212,267	303,095	300,835
	USSR	0	0	0	0	5,000	62,200	101,000	188,200	146,600	99,400	86,300	44,400
	ROK	0	0	0	0	0	0	0	0	0	0	0	0
All nation total		12,562	14,690	24,697	24,145	51,623	222,425	549,874	714,971	605,965	311,667	389,395	345,235

ANNEX IIIC (cont'd)

Species	Nation	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976[3]
Pollock	Japan	261,694	550,152	701,124	830,525	1,231,347	1,514,030	1,616,532	1,471,189	1,250,654	1,065,078	912,728
	USSR	—	—	—	33,571	35,590	233,511	213,895	280,005	309,613	216,567	175,539
	ROK	0	0	1,200	5,000	5,000	10,000	9,200	3,100	26,000	3,438	84,987
	TOTAL	261,694	550,152	702,324	869,096	1,271,937	1,757,541	1,839,627	1,754,294	1,586,267	1,285,083	1,173,254
Pacific cod	Japan	18,200	31,982	57,915	50,487	70,078	40,555	35,877	40,817	45,915	33,322	29,086
	USSR	—	—	—	—	—	2,486	7,028	12,569	16,547	18,229	17,756
	ROK	0	0	—	—	—	—	—	—	—	—	716
	TOTAL	18,200	31,982	57,915	50,487	70,078	43,041	42,095	53,386	62,462	51,551	47,558
Pac. ocean perch and other rockfish	Japan	16,786	20,598	26,214	16,150	10,392	10,369	5,837	3,147	6,811	3,716	3,163
	USSR	9,000	—	3,087	—	—	—	150	475	31,877	16,465	12,124
	ROK	0	0	—	—	—	—	—	—	—	—	578
	TOTAL	25,786	20,598	29,301	16,150	10,392	10,369	5,987	3,622	38,688	20,181	15,865
Blackcod	Japan	9,502	10,330	10,143	14,454	8,897	12,304	10,643	4,769	4,189	2,776	2,569
	USSR	—	1,237	4,256	1,579	2,874	2,830	2,137	1,192	77	38	29
	ROK	0	0	—	—	—	—	—	—	—	—	115
	TOTAL	9,502	11,567	14,399	16,033	11,771	15,134	12,780	5,961	4,266	2,814	2,713
Yellowfin sole	Japan	45,423	60,429	40,834	81,449	59,851	82,179	34,846	75,724	37,947	59,715	33,328
	USSR	56,930	101,799	43,355	85,685	73,228	78,220	13,010	2,516	4,288	6,060	3,343
	ROK	0	0	—	—	—	—	—	—	—	—	635
	TOTAL	102,353	162,228	84,189	167,134	133,079	160,399	47,856	78,240	42,235	65,775	37,306
Rock sole	Japan	4,037	1,890	2,633	4,285	9,616	20,159	43,055	22,840	17,311	9,682	7,828
	USSR	5,067	2,872	2,617	4,955	10,507	20,260	17,769	995	2,664	1,463	785
	ROK	0	0	—	—	—	—	—	—	—	—	150
	TOTAL	9,104	4,762	5,250	9,240	20,123	40,419	60,824	23,835	19,975	11,145	8,763
Flathead sole	Japan	4,996	10,621	11,851	9,168	20,088	25,538	9,850	17,190	12,889	4,873	6,911
	USSR	6,024	12,816	9,724	9,395	21,064	25,486	5,840	951	2,028	672	692
	ROK	0	0	—	—	—	—	—	—	—	—	132
	TOTAL	11,020	23,437	21,575	18,563	41,152	51,024	15,690	18,141	14,917	5,545	7,735
Alaska plaice	Japan	2,054	1,340	1,223	3,127	1,326	517	171	1,082	2,168	2,407	2,064
	USSR	2,579	2,513	1,396	3,815	2,076	475	119	35	220	207	207
	ROK	0	0	—	—	—	—	—	—	—	—	40
	TOTAL	4,633	3,853	2,619	6,942	3,402	992	290	1,117	2,388	2,614	2,311
Pacific halibut	Japan	2,199	3,756	2,775	2,764	1,735	4,861	955	644	81	137	87
	USSR	—	—	—	—	—	—	490	296	123	137	58
	ROK	0	0	—	—	—	—	—	—	—	—	—
	TOTAL	2,199	3,756	2,775	2,764	1,735	4,861	1,445	940	204	274	145
Arrowtooth flounder	Japan					9,354	11,603	3,823	4,929	2,823	1,241	1,652
	USSR					3,244	7,189	9,301	4,288	18,650	19,591	16,132
	ROK					—	—	—	—	—	—	32
	TOTAL					12,598	18,792	13,124	9,217	21,473	20,832	17,816
Greenland turbot	Japan	10,842	21,230	19,980	19,231	14,715	30,193	49,813	43,354	58,834	52,625	17,583
	USSR	2,200	2,639	15,252	16,798	4,976	10,271	14,697	11,926	10,820	12,194	8,867
	ROK	0	0	—	—	—	—	—	—	—	—	335
	TOTAL	13,042	23,869	35,232	36,029	19,691	40,464	64,510	55,280	69,654	64,819	26,785
Other ground-fish	Japan	2,239	4,378	2,984	4,182	9,227	29,617	32,370	39,911	47,491	42,531	44,504
	USSR	—	—	19,074	6,277	6,068	3,879	78,523	15,915	12,770	12,314	12,294
	ROK	0	0	—	—	—	—	—	—	—	—	322
	TOTAL	2,239	4,378	22,058	10,459	15,295	33,496	110,893	55,826	60,261	54,845	57,120
All ground-fish total	Japan	377,972	716,706	877,676	1,035,822	1,446,626	1,781,925	1,843,772	1,725,596	1,487,113	1,278,103	1,061,503
	USSR	81,800	123,876	98,761	162,075	159,627	384,607	362,959	331,163	409,677	303,937	247,826
	ROK	0	0	1,200	5,000	5,000	10,000	9,200	3,100	26,000	3,438	88,042
All nation total		459,772	840,582	977,637	1,202,897	1,611,253	2,176,532	2,215,931	2,059,859	1,922,790	1,585,478	1,397,371

1/ Catch statistics up to 1963 from Forrester et al., 1974, and for 1964-76 from data on file, Northwest and Alaska Fisheries Center, Seattle, with the following exceptions: Pacific ocean perch and other rockfish—Japanese catches 1960-63 and USSR catches 1960-66 from Chikuni 1975; blackcod—Japanese catches 1958-63 from Sasaki 1976; and all flounders except halibut—all nation catches, 1954-75 from Wakabayashi and Bakkala 1977.

2/ 0 means no fishing, — means fishing, but no reported catch.

3/ Japanese catches for November and December 1976 not included; USSR and ROK catches of flounders (except halibut) prorated to species based on species composition of Japanese catches.

ANNEX IIIC (cont'd)

Foreign catches of groundfish in the eastern Bering Sea (east of 180°) by calendar year, 1976-77.[1/] [2/]

Species	Nation	1976	1977[3/]
Pollock	Japan	986,696	774,450
	USSR	175,539	63,383
	ROK	84,987	39,895
	ROC	0	1,334
	Total	1,247,222	879,062
Pacific cod	Japan	32,009	33,141
	USSR	17,756	178
	ROK	716	-
	ROC	0	2
	Total	50,481	33,321
Pacific ocean perch and other rockfish	Japan	3,300	7,761
	USSR	12,124	90
	ROK	578	478
	ROC	0	-
	Total	16,002	8,329
Blackcod	Japan	2,815	2,801
	USSR	29	-
	ROK	115	9
	ROC	0	53
	Total	2,959	2,863
Yellowfin sole	Japan	52,673	58,139
	USSR	2,908	284
	ROK	655	-
	ROC	0	55
	Total	56,236	58,478
Rock sole	Japan	8,598	4,906
	USSR	1,328	805
	ROK	107	-
	ROC	0	5
	Total	10,033	5,716
Flathead sole	Japan	7,379	7,025
	USSR	795	1,069
	ROK	90	-
	ROC	0	6
	Total	8,264	8,100
Alaska plaice	Japan	3,519	3,118
	USSR	102	516
	ROK	44	-
	ROC	0	3
	Total	3,665	3,637

ANNEX IIIC (cont'd)

Pacific halibut	Japan	88	-
	USSR	58	-
	ROK	-	-
	ROC	0	2
	Total	146	2
Arrowtooth flounder	Japan	1,717	6,758
	USSR	16,132	669
	ROK	2	-
	ROC	0	4
	Total	17,851	7,431
Greenland turbot	Japan	51,677	31,942
	USSR	8,867	3,082
	ROK	425	-
	ROC	0	18
	Total	60,969	35,042
Other groundfish	Japan	13,527	26,950
	USSR	12,294	614
	ROK	322	1,445
	ROC	0	-
	Total	26,143	29,009
All groundfish total	Japan	1,163,998	956,991
	USSR	247,932	70,690
	ROK	88,041	41,827
	ROC	0	1,482
All nation total		1,499,971	1,070,990

Updated footnotes for Annex 3B and 3C, Bering Sea Groundfish MP

1/ Catch statistics up to 1963 from Forrester et al. 1974 and for 1964-76 from data on file, Northwest and Alaska Fisheries Center, with the following exceptions: Pacific ocean perch and other rockfish - USSR catches for 1963-66 from Chikuni 1975; all flounders except halibut - all national catches, 1963-76 from Wakabayashi and Bakkala, 1978.

2/ 0 indicates no fishing, -- indicates fishing, but no catch reported.

3/ Catches of flounders by USSR and ROK are preliminary.

ANNEX IV

INFORMATION ON MARINE MAMMAL POPULATION

Information on distribution and migration, abundance and trends, feeding habits, and any problems induced by fisheries on seven marine mammal populations in the Bering Sea/Aleutian Region was provided by the Marine Mammal Division of the Northwest and Alaska Fisheries Center and included in this annex, the information if summarized mainly from the annual report of the Department of Commerce on the Administrative of the Marine Mammal Protection Act of 1972 for the period of April 1, 1977 through March 31, 1978 (DOC, 1978) and the Final Environmental Impact Statement on Consideration of a Waiver of the Moratorium and Return of Management of Certain Marine Mammals to the State of Alaska, Volumes I and II (DOC and DOI, 1977).

NORTHERN SEA LION (Eumetopias jubatus)

Distribution and Migration: The northern (stellar) sea lion is found in continental shelf water from the Sea of Japan and northern Honshu, Japan, northward around the North Pacific Ocean rim to Okhotsk and Bering Sea and southward to the California Channel Islands. Some seasonal movements occur in parts of its range.

Abundance and Trends: Mate (1976) estimated a world population of 250,000 to 325,000 animals. Alaska has 202 know rookeries and hauling grounds. The Alaska population has increased since exploitation diminished in the early 1900's and now exceeds 200,000 according to a 1973 ADF&G estimate. However, recent studies in the eastern Aleutian Islands indicate a 50% decline in population sizes since the late 1950's (Braham et al, 1977).

Factors which may have caused this decline include (1) a westward shift in distribution, (2) commercial fisheries interaction, (3) leptospirosis and/or (4) unidentified population control factor.

Feeding Habits: Norther sea lions eat a variety of fish and cephalopods. Based on frequency of occurrence, one study revealed that fish composed 74.2% of the diet, cephalopod - 17.2 %, and decapod crustaceans - 8.6% Analysis based on percentage of total individuals provided a some what different picture. Fishes completely dominated the diet at 97.6% of total individuals. Cephalopods followed at 2.0% and decapod crustaceans at 0.6%. Groundfishes constituted 57.7% of the sea lion diet based frequency of occurrence and 90.8% based on percentage of total individuals (Clakins and Pitcher, 1977). Pollock was the dominate groundfish. Details of the diet are summarized as follows:

Area: Cape Spencer to Scotch Cap on Unimak Island
Northern Sea Lions - 68 Samples

Prey Item	No. of Occurrences	% Occurrences	No. of Individuals	% of Total Individuals
Gadidae	57	49.1	1135	89.2
Pollock	47	40.5	1072	84.3
Pacific cod	6	5.2	33	2.6
Other Gadidae	4	3.4	30	2.3
Scorpaenidae				
Rockfishes	2	1.7	6	0.5
Pleuronectidae	8	6.9	14	1.1
Starry Flounder	1	0.9	1	0.2
Rock Sole	1	0.9	1	0.1
Yellowfin sole	1	0.9	2	0.2
Flathead sole	2	1.7	2	0.2
Other Pleuronectidae	3	2.5	8	0.4
Total Groundfish	67	57.7	1155	90.8

Problems: Northern sea lions have damaged gear and destroyed fish in halibut longline, salmon purse seine, gillnet, and troll fisheries. Because groundfish make up such a large part of the sea lion's diet, this species will probably be one of the marine mammals most impacted by the groundfish fisheries and will be the species which should bear close watching as groundfish policies considered. This is important in light of recent declines in populations in the eastern Aleutian Islands.

NORTHERN FUR SEA (Callorhinus ursinus)

Distribution and Migration: Northern fur seals are found at sea along the continental shelf from the Bering Sea south along both sides of the North Pacific Ocean to latitude 32°N. Most animals are on their breeding grounds from May through November to bear young to breed.

Abundance and Trends: A program of reducing the population of Pribilof Island fur seals was begun in 1956 with the expectation that the rate of survival would improve and result in an increased yield of pelts. By 1968, the population has been reduced below levels which would yield the maximum sustainable yield. Thus female fur seals were excluded from harvest in expectation that there would be an increase in pup production. However, expected increases have not been observed. The population levels of the northern fur seal is estimated to be 1,765,000. There are in excess of 700,000 adults in the eastern Bering Sea in summer.

Feeding Habits: The northern fur seal is an opportunistic feeder, taking squid and a variety of fishes including herring, anchovy, salmon, capelin, saury, walleyed pollock, and mackerel. Fishes are estimated to constitute about 80% of the fur sea diet. Average size of pollock (the dominant food item observed in fur seal stomachs is 20 cm. Some figures, from McAlister and Perez (1977) indicated the following consumptions of groundfish by northern fur seals.

	In the Aleutians	In the Bering Sea
Walleye pollock	9.4%	39.4%
Sablefish	4.8%	1.0%
Other Gadidae		5.7%
Pleuronectidae	___	1.4%
% Groundfish	14.2%	47.5
% Other fish	75.0%	31.8%
Total fish	89.2%	79.3%
Total squid	10.8%	20.7%

Problems: Fur seals and commercial fisheries may compete for the same species of fish.

BEARDED SEAL (Erignathus barbatus)

Distribution and Migration: The bearded seal is found in the North Pacific region in the Bering, Okhotsk, and northern Japan Seas. Bearded seals migrate seasonally in association with the advance and retreat of the ice packs. These seals do not normally come ashore.

Abundance and Trends: No satisfactory method of accurately censusing bearded seals has been attempted to date. A 1971 Soviet estimate places the level of bearded sea populations of the East-Siberian, Chukchi, Bering, Okhotsk, and Japan Seas at 450,00. The Alaska Department of Fish and Game (1973) estimated a populations of 300,000 animals in the Bering, Chukchi, East-Siberian, and Beaufort Seas. The population appears to be high and stable (DOC, 1978).

Feeding Habits: The bearded seal consumes several species of invertebrates, primarily crabs, shrimps, clams, and amphipods, and some demersal fishes. One study indicates that fishes constitute about 10% of the bearded seal's diet and another study, performed in the Beaufort Sea, stated that about 25% of this animal's diet is fishes, in this case primarily polar cod.*

Problems: None at the present. Bearded seals consume commercially important pandalid and crangoid shrimps and lithods crabs; however, they do not compete directly for commercial fish nor do they damage fishing gear.

*Lowry, Frost, and Burns. Trophic relationships Among Ice Inhabiting Seals. Environmental Assessment of the Alaska Continental Shelf, PI Annual Report, March 77, Vol. 1, p. 226.

> Area: North and east of Pt. Barrow
> Bearded seals: 3 samples
> Of the three samples, one consisted of only one shrimp. One of the seals was taken in November and 64% of the contents were invertebrates and 36% of the contents were fish, mostly saffron cod, but also polar cod, sea snail and eelpout. The third sea was taken in August and it contained 83% invertebrates, mostly isopods. Of the fish in the stomach, 53% were polar cod, 38% were sculpins, and 5% were sea snails. The authors concluded that bearded seals eat a diverse diet but the bulk of it is bivalve mollusk, crabs, shrimps, and sculpins.

RINGED SEA (Phoca hispida)

Distribution and Migration: The ringed seal is circumarctic in distributions throughout the ice pack. In the North Pacific Ocean it is found in the Bering, Chukchi, and Okhotsk Seas and in the permanent ice pack of the Polar Basin. In winter, most ringed seals occupy areas of land-fast ice, but non-breeding adults and juveniles may be found wherever ice occurs. Apparently, animals wintering in the Bering and Chukchi Seas move northward in spring as the ice recedes and southward in autumn as it advances again. In western Alaska, the ringed seal is the dominant nearshore seal during ice-free months.

Abundance and Trends: No satisfactory method of accurately censusing ringed seals, through their range, has been attempted to date. The Alaska Department of Fish & Game (1973) estimated the ringed seal population in the Bering-Chukchi Seas to be about 250,000. Annual harvest by both Soviets and Americans in this area are between 12,000 and 16,000 animals per year. Overall, the population in the Bering-Chukchi Seas appears to be high and is probably stable.

Feeding Habits: In western Alaska, this seal feeds mainly on mysids, amphipods, euphasiids, shrimps, saffron cod, polar cod, and sculpin. A recent stomach analysis of ringed seals in the Beaufort Sea reported that about 83% of the ringed seal's diet was invertebrates and about 17% was fish, almost exclusively polar cod.*

Problems: None at the present. Little competition is known to exist between ringed seals and man for fishery resources.

*Lowry, Frost, and Burns. Trophic Relationships Among Ice Inhabiting Seals. Environmental Assessment of the Alaska Continental Shelf, PI Annual, Report, March 1977. Vol. 1, p. 226

Ringed seals - 21 samples.

Fish constituted from 00.0-13% of the food material in various sub-samples. There were 73 polar cod (Boreagradus, saida), one saffron cod (Eleginus gracillus), and tow capelin (Mallotus villesus) found in all the samples. Invertebrates were the bulk of the contents. The authors concluded that ringed seals eat primarily nektonic creatures, small benthic crustaceans, and small to medium-size schoolingfish. Benthic fish are the minor food item.

HARBOR SEAL (Phoca vitulina)

Distribution and Migration: The harbor sea is found in the North Pacific Ocean from the Bering Sea south to Baja California and southern Japan and Korean. The harbor sea is the predominant nearshore seal in ice-free waters north of latitude 35°N.

Abundance and Trends: Overall, the world population of harbor seals appears to be high and stable. A 1976 estimate indicated a population of 312,500 to 317,500 in the Pacific (Adv. Comm. Mar. Resour. Res., 1976).

Feeding Habits: The diet of the harbor seal, which varies according to season and location of specific populations, includes primarily pelagic, demersal, and anadromous fishes, cephalopods, and crustaceans. About half of this seal's diet is fish.

Problems: These seals damage commercial fishing gear and compete with man for fish as herring, salmon, smelt, and whitefish. These animals are extremely sensitive to disturbance and may leave an area after continual harassment by people, equipment, or aircraft.

LARGE SEAL (Phoca largha)

Distribution and Migration: The larga seal is found in the Bering, Chukchi, Western Beaufort, Okhotsk, norther Sea of Japan, and the Po Hai Seas. These seals are seasonally dependent upon sea ice for the birth and nurture of their pups. During winter and early spring the entire population is concentrated along the southern edge of the seasonal pack ice, usually in central Bering Sea. These seals move northward and toward the coasts as the seasonal retreat and disintegration of sea ice progresses. During ice-free summer and early fall they occur along the entire coast of northern Alaska.

Abundance and Trends: No satisfactory method of accurate censusing lara seals has been attempted to date. Indirect methods and relative indices of abundances indicate that the population level of this species is high and probably stable. In 1976, the Bering Sea larga seal population was estimated to contain from 135,000 to 200,000 animals. The Okhotsk Sea population estimates is 135,00 to 200,000 animals (DOC, 1978).

Feeding Habits: The diet of these seals, which varies with the season and location, includes primarily pelagic, demersal and anadromous fishes, cephalopods and crustaceans.

Ecological Problems: Competition presently exists between these seals and man with respect to commercially important fishes (i.e., herring, smelt, whitefish, and salmon) and with respect to fishing gear. These seals are extremely responsive to disturbance and will leave a hauling area after only minor harassment.

RIBBON SEAL (Phoca fasciata)

Distribution and Migration: Geographically, the ribbon seal is separable into Okhotsk and Bering-Chukchi Sèa populations and interchanges between the two groups are not known to occur. During winter and spring, the entire population is concentrated along the southern edge of the seasonal ice pack. Only a few ribbon seals remain with the ice edge of the seasonal ice pack. Only a few ribbon seals remain with the ice edge as it retreats northward through the Bering Strait. In summer and autumn, ribbon seas are believed to be pelagic, mainly in the ice-free Bering Sea.

Abundance and Trends: The population of ribbon seals is relatively low, having been markedly reduced by commercial sealers of the Soviet Union during the 1960s. In recent years the species has been afforded increased protection by Soviet sealing regulations and its numbers may be increasing again. U.S. citizens harvest very few ribbon seals. The Alaska Department of Fish& Game (1973) estimated that the population probably numbers between 90,000 and 100,000 animals. Soviet estimates indicate a population of 133,000 in the Okhotsk in 1969 (Popov, 1976). Soviet sealers took less than 3,000 ribbon seals in 1973 form Bering and Okhotsk Seas. In Alaska, the native harvest is usually less than 250 per year.

Food Habits: The diet of the ribbon seal during late winter and early spring (in the ice edge zone) includes mainly pelagic and demersal fishes, cephalopods, and small crustaceans. About 40% of this animal's summer diet is fishes and about 90% of its winter diet is fishes.

Problems: Little competition is known to exist between ribbon seals and man for fishery resources.

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ANNEX V -- Species Categories Which Apply to the Bering Sea/Aleutian Groundfish Fishery

Prohibited Species1/	Target Species2/	"Other" Species3/	Nonspecified Species4/	
Finfishes				
Domestic:	Pollock	Sculpins	Eelpouts (family Zoarcidae)	
Pacific halibut	Cod	Sharks	Poachers (family Agonidae) and alligator fish	
Pacific herring	Atka Mackerel	Skates	Snailfish, Lumpfishes, Lumpsuckers (family Cyclopteridae)	
Pacific salmon	Sablefish	Eulachon	Sandfishes (Trichodon sp.)	
Steelhead	Pacific Ocean Perch	Smelts	Rattails (family Macrounidae)	
Other Rockfishes	Capelin		Ronquils, Searchers (family Bathymasteridae)	
Foreign:	Yellowfin Sole		Lancetfish (family Alepisanvidae)	
Pacific halibut	Turbots		Pricklebacks, Cockscombs, Warbonnets, Shanny (family Stichaeidae)	
Pacific herring	Other Flatfishes		Prowfish (Zaprora silenus)	
Salmonids			Hagfish (Eptatretus sp.)	
			Lampreys (Lampetra sp.)	
			Blennys, Gunnels, (Various small bottom dwelling fishes of the family Stichaeidae and Pholidae)	
Invertebrates				
Domestic:	Squids	Octopus	Anemones	Jellyfishes
King crab			Starfishes	Tunicates
Tanner crab			Egg Cases	Sea Cucumber
	Sea Mouse	Sea Pen		
Foreign:			Sea Slug	Isopods
King crab			Sea Potato	Barnacles
Tanner crab			Sand Dollar	Polychaetes
Other unallocated species			Hermit Crab	Crinoids
			Mussels	Crab - unident.
			Sea Urchins	Misc. - unident.
			Sponge - unident.	

1/ Must be returned to the sea, no fee.
2/ TAC for each item; fee as in fee schedule.
3/ Aggregate TAC for group.
4/ List not exclusive; includes any species not listed under Prohibited, Target, or "Other" categories; no fee charged.