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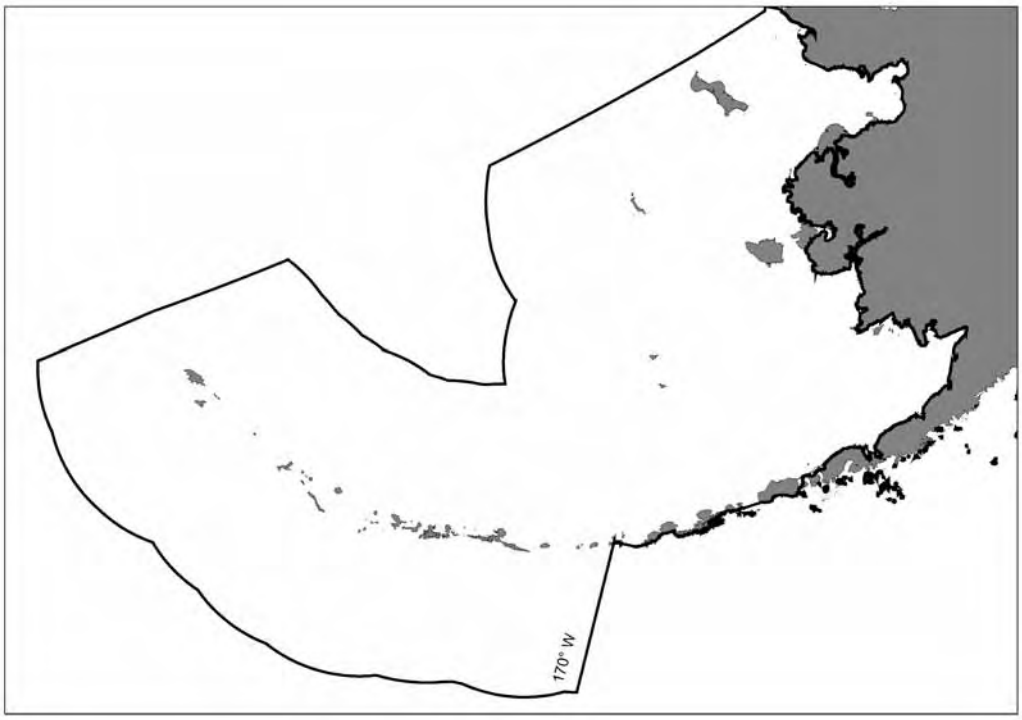
BERING SEA AND ALEUTIAN ISLANDS GROUNDFISH FISHERY MANAGEMENT PLAN



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Executive Summary

This Fishery Management Plan (FMP) governs groundfish fisheries of the Bering Sea and Aleutian Islands Management Area (BSAI). The FMP management area is the United States (U.S.) Exclusive Economic Zone (EEZ) of the Bering Sea and that portion of the North Pacific Ocean adjacent to the Aleutian Islands which is between 170° W longitude and the U.S.-Russian Convention Line of 1867. The FMP covers fisheries for 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.

The FMP was implemented on January 1, 1982. As of April 2004, it has been amended over seventy times, and its focus has changed from the regulation of mainly foreign fisheries to the management of fully domestic groundfish fisheries. This version of the FMP has been revised to remove or update obsolete references, as well as outdated catch data and other scientific information. The FMP has also been reorganized to provide readers with a clear understanding of the BSAI groundfish fishery and conservation and management measures promulgated by the FMP.

ES.1 Management Policy

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) is the primary domestic legislation governing management of the nation's marine fisheries. In 1996, the United States Congress reauthorized the Magnuson-Stevens Act to include, among other things, a new emphasis on the precautionary approach in U.S. fishery management policy. The Magnuson-Stevens Act contains ten national standards, with which all FMPs must conform and which guide fishery management. Besides the Magnuson-Stevens Act, U.S. fisheries management must be consistent with the requirements of other regulations including the Marine Mammal Protection Act, the Endangered Species Act, the Migratory Bird Treaty Act, and several other Federal laws.

Under the Magnuson-Stevens Act, the North Pacific Fishery Management Council (Council) is authorized to prepare and submit to the Secretary of Commerce for approval, disapproval or partial approval, a FMP and any necessary amendments, for each fishery under its authority that requires conservation and management. The Council conducts public hearings so as to allow all interested persons an opportunity to be heard in the development of FMPs and amendments, and reviews and revises, as appropriate, the assessments and specifications with respect to the optimum yield from each fishery (16 U.S.C. 1852(h)).

The Council has developed a management policy and objectives to guide its development of management recommendations to the Secretary of Commerce. This management approach is described in Table ES-1.

Table ES-1 BSAI Groundfish Fisheries Management Approach

The Council's policy is to apply judicious and responsible fisheries management practices, based on sound scientific research and analysis, proactively rather than reactively, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future, as well as current generations. The productivity of the North Pacific ecosystem is acknowledged to be among the highest in the world. For the past 25 years, the Council management approach has incorporated forward looking conservation measures that address differing levels of uncertainty. This management approach has in recent years been labeled the precautionary approach. Recognizing that potential changes in productivity may be caused by fluctuations in natural oceanographic conditions, fisheries, and other, non-fishing activities, the Council intends to continue to take appropriate measures to insure the continued sustainability of the managed species. It will carry out this objective by considering reasonable, adaptive management measures, as described in the Magnuson-Stevens Act and in conformance with the National Standards, the Endangered Species Act (ESA), the National Environmental Policy Act, and other applicable law. This management approach takes into account the National Academy of Science's recommendations on Sustainable Fisheries Policy.

As part of its policy, the Council intends to consider and adopt, as appropriate, measures that accelerate the Council's precautionary, adaptive management approach through community-based or rights-based management, ecosystem-based management principles that protect managed species from overfishing, and where appropriate and practicable, increase habitat protection and bycatch constraints. All management measures will be based on the best scientific information available. Given this intent, the fishery management goal is to provide sound conservation of the living marine resources; provide socially and economically viable fisheries for the well-being of fishing communities; minimize human-caused threats to protected species; maintain a healthy marine resource habitat; and incorporate ecosystem-based considerations into management decisions.

This management approach recognizes the need to balance many competing uses of marine resources and different social and economic goals for sustainable fishery management, including protection of the long-term health of the resource and the optimization of yield. This policy will use and improve upon the Council's existing open and transparent process of public involvement in decision-making.

ES.2 Summary of Management Measures

The management measures that govern the Bering Sea and Aleutian Islands groundfish fishery are summarized in Table ES-2.

Pursuant to Title II of the Magnuson-Stevens Act, there is no allowable level of foreign fishing for the groundfish fisheries covered by this FMP. Fishing vessels and fish processors of the U.S. have the capacity to harvest and process up to the level of optimum yield of all species subject to this FMP.

Table ES-2 Summary of Management Measures for the BSAI Groundfish Fishery

Management Area	U.S. Exclusive Economic Zone (EEZ) of the eastern Bering Sea and 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. **Subareas:** The area is divided into two subareas, the Bering Sea and the Aleutian Islands.
Stocks	All stocks of finfish and marine invertebrates in the management area except salmonids, shrimps, scallops, snails, king crab, Tanner crab, Dungeness crab, corals, surf clams, horsehair crab, lyre crab, Pacific halibut, and Pacific herring. Those stocks and stock complexes that are commercially important and for which an annual TAC is established include: walleye pollock, Pacific cod, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, “other flatfish”, Pacific ocean perch, northern rockfish, shortraker and rougheye rockfish, “other rockfish”, Atka mackerel, and squid.
Maximum Sustainable Yield (MSY)	The MSY of the BSAI groundfish complex is 1.7 to 2.4 million mt.
Optimum Yield (OY)	The OY of the BSAI groundfish complex (consisting of stocks listed in the ‘target species’ and ‘other species’ categories, as listed in Table 3-1) is 1.4 to 2.0 million mt, plus the incidental harvest of nonspecified species.
Procedure to set Total Allowable Catch (TAC)	Based on the annual Stock Assessment and Fishery Evaluation (SAFE) report, the Council will recommend to the Secretary of Commerce TACs and apportionments thereof for each target species and the “other species” category. The Secretary will implement annual TACs which may cover up to 2 fishing years, following public comment and Council recommendations at the December Council meeting. **Reserve**: 15% of the TAC for each target species (except pollock and fixed-gear sablefish) and the “other species” category is set aside to form the reserve, used for correcting operational problems of the fleets, adjusting species TACs for conservation, or apportionments. The reserve is not designated by species or species groups.
Apportionment of TAC	**Pollock**: the amount of pollock that may be taken with non-pelagic trawls may be limited; pollock TAC shall be divided into roe-bearing (“A” season) and non roe-bearing (“B” season) allowances. **Sablefish**: vessels using fixed gear may harvest no more than 50% of the TAC in the Bering Sea and 75% of the TAC in the Aleutian Islands; vessels using trawl gear may harvest no more than 50% of the TAC in the Bering Sea and 25% of the TAC in the Aleutian Islands. **Pacific cod**: TAC shall be allocated 2% to vessels using jig gear, 47% to vessels using trawl gear, and 51% to vessels using hook-and-line or pot gear; the allocation to hook-and-line and pot gear will be further allocated 80% to hook-and-line catcher/processor vessels, 0.3% to hook-and-line catcher vessels, 3.3% to pot catcher/processor vessels, 15% to pot catcher vessels, and 1.4% to catcher vessels less than 60' LOA; allocations may be seasonally apportioned. **Atka mackerel**: up to 2% of the eastern Aleutian Islands and Bering Sea TACs will be allocated to vessels using jig gear. **Shortraker and rougheye rockfish**: after subtraction of reserves, the Aleutian Islands TAC will be allocated 70% to vessels using trawl gear and 30% to vessels using non-trawl gear.
Permit	All vessels participating in the BSAI groundfish fisheries, other than fixed gear sablefish, require a Federal groundfish license, except for: vessels fishing in State of Alaska waters; vessels less than 32' LOA; and jig gear vessels less than 60' LOA that meet specific effort restrictions. Licenses are endorsed with area, gear, and vessel type and length designations. Vessels engaged in directed fishing for Pacific cod must qualify for a Pacific cod endorsement. Fishing permits may be authorized, for limited experimental purposes, for the target or incidental harvest of groundfish that would otherwise be prohibited.
Authorized Gear	Gear types authorized by the FMP are trawls, hook-and-line, pots, jigs, and other gear as defined in regulations. **Pollock**: The use of non-pelagic trawl gear in the directed fishery for pollock is prohibited.

Table ES-2 Summary of Management Measures for the BSAI Groundfish Fishery

Time and Area Restrictions	**All trawl**: Fishing with trawl vessels is not permitted year-round in the Crab and Halibut Protection Zone and the Pribilof Islands Habitat Conservation Area. The Nearshore Bristol Bay Trawl Closure area is also closed year-round except for a subarea that remains open between April 1 and June 15 each year. The Chum Salmon Savings Area is closed to trawling from August 1 through August 31. **Non-pelagic trawl**: The Red King Crab Savings Area is closed to non-pelagic trawling year-round, except for a subarea that may be opened at the discretion of the Council and NMFS when a guideline harvest level for Bristol Bay red king crab has been established. **Directed pollock fishery**: Between September 1 and the date that closes the directed "B" season pollock fishery to the inshore component, vessels in the offshore component or vessels delivering to the offshore component are prohibited from directed fishing for pollock in the Catcher Vessel Operational Area unless they are participating in a community development quota fishery. **Marine mammal measures**: Regulations implementing the FMP may include conservation measures that temporally and spatially limit fishing effort around areas important to marine mammals. **Gear test area exemption**: Specific gear test areas for use when the fishing grounds are closed to that gear type, are established in regulations that implement the FMP.
Prohibited Species	Pacific halibut, Pacific herring, Pacific salmon and steelhead, king crab, and Tanner crab are prohibited species and must be returned to the sea with a minimum of injury except when their retention is authorized by other applicable law. Groundfish species and species under this FMP for which TAC has been achieved shall be treated in the same manner as prohibited species.
Prohibited Species Catch (PSC) Limits	**Red king crab**: Based on the size of the spawning biomass of red king crab, the PSC limit in Zone 1 for trawl fisheries is either 23,000, 97,000 or 197,000 red king crab; attainment closes Zone 1. ***C. bairdi* crab**: Established in regulation for trawl fisheries based on population abundance; attainment closes Zone 1 or Zone 2. ***C. opilio* crab**: Established in regulation for trawl fisheries in the C. opilio Bycatch Limitation Zone based on population abundance, with minimum and maximum limits; attainment closes zone. **Pacific halibut**: Halibut mortality limits established in regulation for trawl and non-trawl fisheries. **Pacific herring**: 1% of the annual biomass of eastern Bering Sea herring, for trawl fisheries; attainment may close the Herring Savings Areas. **Chum salmon**: Attainment of 42,000 fish limit in the Catcher Vessel Operational Area between August 15 and October 14 closes the Chum Salmon Savings Area for the rest of that time period. **Chinook salmon**: Attainment of chinook PSC limit established in regulation closes the Chinook Salmon Savings Area to directed pollock trawl fishing. **Apportionment**: For trawl fisheries, may be apportioned by target fishery and season; for non-trawl fisheries, may be apportioned by target fishery, gear type, area, and season.
Retention and Utilization Requirements	**Pollock**: Roe-stripping is prohibited; see also below. **Improved Retention/Improved Utilization Program**: All pollock and Pacific cod must be retained and processed.
Fixed Gear Sablefish Fishery	The directed fixed gear sablefish fisheries are managed under an Individual Fishing Quota program. The FMP specifies requirements for the initial allocation of quota share in 1995, as well as transfer, use, ownership, and general provisions. **Annual Allocation**: The ratio of a person's quota share to the quota share pool is multiplied by the fixed gear TAC (adjusted for the community development quota allocation - see below), to arrive at the annual individual fishing quota.

Table ES-2 Summary of Management Measures for the BSAI Groundfish Fishery

Bering Sea Pollock Fishery	Subtitle II of the American Fisheries Act (AFA), incorporated by reference in the FMP, implemented a cooperative program for the pollock fishery. **Access**: Limits pollock fishery access to named vessels and processors; included a buyout of 9 catcher/processor vessels. **Allocation**: After adjustment for the community development quota allocation (see below) and incidental catch of pollock in other fisheries, the pollock TAC is apportioned 50% to vessels harvesting pollock for inshore processing, 40% to vessels harvesting pollock for catcher/processor processing, and 10% to vessels harvesting pollock for mothership processing. **Cooperatives**: Creates standards and limitations for the creation and operation of cooperatives. **Sideboards**: Establishes harvesting and processing restrictions on AFA pollock participants to protect other fisheries. **Catch monitoring**: Increases observer coverage and scale requirements for catcher/processors.
Aleutian Islands Pollock Fishery	The directed pollock fishery in the Aleutian Islands is fully allocated to the Aleut Corporation for the purpose of economic development in Adak, Alaska. **Allocation**: To be funded from the difference between the sum of all BSAI groundfish fishery TACs and the 2 million mt OY cap, if the difference is large enough to do so; otherwise from a reduction in the Bering Sea pollock initial TAC. The allocation is further divided into “A” and “B” season allowances as specified in the FMP.
Community Development Quota (CDQ) Multispecies Fishery	Eligible fishery-dependent communities in western Alaska will receive a percentage of all groundfish species or species group TACs, except squid, and a pro-rata share of PSC species. **Sablefish**: 20% of the fixed gear TAC **Pollock**: 10% of the TAC **Other groundfish species**: 7.5% of the TAC
Flexible Authority	The Regional Administrator of NMFS is authorized to make inseason adjustments through gear modifications, closures, or fishing area/quota restrictions, for conservation reasons, to protect identified habitat problems, or to increase vessel safety.
Recordkeeping and Reporting	Recordkeeping that is necessary and appropriate to determine catch, production, effort, price, and other information necessary for conservation and management may be required. May include the use of catch and/or product logs, product transfer logs, effort logs, or other records as specified in regulations. **Processors**: Shall report necessary information for the management of the groundfish fisheries as specified in regulations. **At-sea processor vessels**: Must submit a weekly catch/receipt and product transfer report and record cargo transfer and off-loading information in a separate transfer log. Catcher/processors are also required to check in and check out of any fishing area for which TAC is established, as specified in regulations.
Observer Program	U.S. fishing vessels that catch groundfish in the EEZ, or receive groundfish caught in the EEZ, and shoreside processors that receive groundfish caught in the EEZ, are required to accommodate NMFS-certified observers as specified in regulations, in order to verify catch composition and quantity, including at-sea discards, and collect biological information on marine resources.
Evaluation and Review of the FMP	The Council will maintain a continuing review of the fisheries managed under this plan. **Management Policy**: Objectives in the management policy statement will be reviewed annually. **Essential Fish Habitat (EFH)**: The Council will conduct a complete review of EFH once every 5 years, and in between will solicit proposals on Habitat Areas of Particular Concern and/or conservation and enhancement measures to minimize potential adverse effects from fishing. Annually, EFH information will be reviewed in the “Ecosystems Considerations” chapter of the SAFE report. **PSC limits and related area closures**: Will be reviewed each year to determine whether changes in stock abundance or other factors justify consideration of alternative limits or closures.

ES.3 Organization of the FMP

The FMP is organized into six chapters. Chapter 1 contains an introduction to the FMP, and Chapter 2 describes the policy and management objectives of the FMP.

Chapter 3 contains the conservation and management measures that regulate the BSAI groundfish fisheries. Section 3.1 denotes the area and stocks governed by the FMP, and describes the five categories of species or species groups likely to be taken in the groundfish fishery. Section 3.2 specifies the procedures for determining harvest levels for the groundfish species, and includes the maximum sustainable yield and optimum yield of the groundfish complex. Sections 3.3 to 3.6 contain permit and participation, gear, time and area, and catch restrictions for the groundfish fisheries, respectively. Section 3.7 describes the specific management measures for the quota share programs in place in the fixed gear sablefish fishery, the pollock fishery, and the community development quota multispecies fishery. Measures that allow flexible management authority are addressed in Section 3.8, and Section 3.9 designates monitoring and reporting requirements for the fisheries. Section 3.10 describes the schedule and procedures for review of the FMP or FMP components.

Chapter 4 contains a description of the stocks and their habitat (including essential fish habitat definitions), fishing activities, the economic and socioeconomic characteristics of the fisheries and communities, and ecosystem characteristics. Additional descriptive information is also contained in the appendices. Chapter 5 specifies the relationship of the FMP with applicable law and other fisheries. Chapter 6 references additional sources of material about the groundfish fisheries, and includes the bibliography.

Appendices to the FMP include supplemental information. Appendix A contains a history of the BSAI groundfish FMP, including a summary of its amendments. Appendix B describes the geographical coordinates for the areas specified in the FMP. Appendix C incorporates sections of the American Fisheries Act that are referenced in the BSAI groundfish fishery management measures. Appendices D, E, and F include, respectively, habitat information by life stage for managed species, maps of essential fish habitat, and a discussion of adverse effects on essential fish habitat. Appendix G summarizes FMP impacts on fishery participants and fishing communities. Appendix H examines research needs in the BSAI groundfish fisheries. Appendix I includes information about marine mammals and seabirds interacting with the BSAI groundfish fisheries, including species listed under the Endangered Species Act.

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Acronyms and Abbreviations Used in the FMP

'	minutes
%	percent
ABC	acceptable biological catch
AFA	American Fisheries Act
AI	Aleutian Islands
ALT	Alaska Local Time
B	biomass
BSAI	Bering Sea and Aleutian Islands
$B_{x\%}$	biomass that results from a fishing mortality rate of $F_{x\%}$
C	Celsius or Centigrade
C.F.R.	Code of Federal Regulations
CDP	community development plan
CDQ	community development quota
cm	centimeter(s)
COBLZ	C. Opilio Bycatch Limitation Zone
Council	North Pacific Fishery Management Council
CVOA	catcher vessel operational area
DAH	domestic annual harvest
DAP	domestic annual processed catch
E.	East
EEZ	exclusive economic zone
EFH	essential fish habitat
EY	equilibrium yield
F	fishing mortality rate
FOCI	Fisheries-Oceanography Coordinated Investigations
FMP	fishery management plan
ft	foot/feet
$F_{x\%}$	fishing mortality rate at which the SPR level would be reduced to *X%* of the SPR level in the absence of fishing
GHL	guideline harvest level
GMT	Greenwich mean time
HAPC	habitat area of particular concern
IFQ	individual fishing quota
IPHC	International Pacific Halibut Commission
IR/IU	Improved Retention/Improved Utilization Program
JVP	joint venture processed catch
kg	kilogram(s)
km	kilometer(s)
lb	pound(s)
LLP	licence limitation program
LOA	length overall
m	meter(s)
M	natural mortality rate
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
mm	millimeter(s)
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	maximum sustainable yield
mt	metric ton/s
N.	North
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
NPFMC	North Pacific Fishery Management Council
OFL	overfishing level
OY	optimum yield
pdf	probablity density function
POP	Pacific ocean perch
ppm	part(s) per million
ppt	part(s) per thousand
PSC	prohibited species catch
QS	quota share(s)
RKCSA	Red King Crab Savings Area
S.	South
SAFE	Stock Assessment and Fishery Evaluation
SPR	spawning per recruit
SSC	North Pacific Fishery Management Council's Scientific and Statistical Committee
TAC	total allowable catch
TALFF	total allowable level of foreign fishing
U.S.	United States
U.S.C.	United States Code
USSR	United Soviet Socialist Republics
W.	West
°	degrees

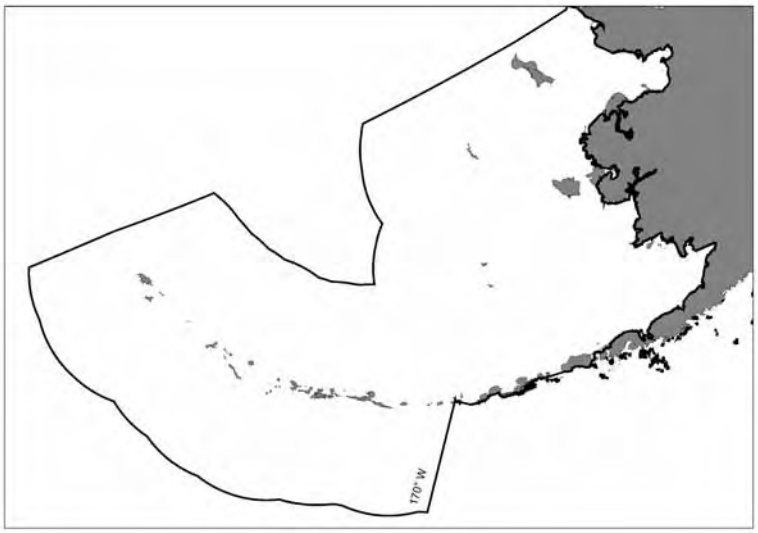
Chapter 1 Introduction

This Fishery Management Plan (FMP) governs groundfish fisheries of the Bering Sea and Aleutian Islands (BSAI) Management Area. The geographical extent of the FMP management unit is the United States (U.S.) Exclusive Economic Zone (EEZ) of the Bering Sea, including Bristol Bay and Norton Sound, and that portion of the North Pacific Ocean adjacent to the Aleutian Islands which is between 170° W. longitude and the U.S.-Russian Convention Line of 1867 (Figure 1-1).

The FMP covers fisheries for 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. In terms of both the fishery and the groundfish resource, the BSAI groundfish fishery forms a distinct management area. The history of fishery development, target species and species composition of the commercial catch, bathymetry, and oceanography are all much different in the BSAI than in the adjacent Gulf of Alaska. Although many species occur over a broader range than the BSAI management area, with only a few exceptions (e.g., sablefish), stocks of common species in this region are believed to be different from those in the adjacent Gulf of Alaska.

The International Pacific Halibut Commission is responsible for management of the North American Pacific halibut fishery, under the authority of the Convention for the Preservation of the Halibut Fishery of the North Pacific Ocean and the Bering Sea. The potential adverse impact on halibut from the groundfish fisheries is such 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 FMP. Throughout this document, the term “groundfish” excludes Pacific halibut.

Figure 1-1 Management Area for the Bering Sea and Aleutian Islands



1.1 Foreign Fishing

Title II of the Magnuson-Stevens Act establishes the system for the regulation of foreign fishing within the U.S. EEZ. These regulations are published in 50 CFR 600. The regulations provide for the setting of a total allowable level of foreign fishing (TALFF) for species based on the portion of the optimum yield that will not be caught by U.S. vessels. At the present time, no TALFF is available for the fisheries covered by this FMP, because the U.S. has the capacity to harvest up to the level of optimum yield of all species subject to this FMP. Also, U.S. fish processors have the capacity to process all of the optimum yield of BSAI groundfish.

Chapter 2 Management Policy and Objectives

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) is the primary domestic legislation governing management of the nation's marine fisheries. In 1996, the United States Congress reauthorized the Magnuson-Stevens Act to include, among other things, a new emphasis on the precautionary approach in U.S. fishery management policy. The Magnuson-Stevens Act contains ten national standards, with which all fishery management plans (FMPs) must conform and which guide fishery management. The national standards are listed in Section 2.1, and provide the primary guidance for the management of the groundfish fisheries.

Under the Magnuson-Stevens Act, the North Pacific Fishery Management Council (Council) is authorized to prepare and submit to the Secretary of Commerce for approval, disapproval or partial approval, a FMP and any necessary amendments, for each fishery under its authority that requires conservation and management. The Council conducts public hearings so as to allow all interested persons an opportunity to be heard in the development of FMPs and amendments, and reviews and revises, as appropriate, the assessments and specifications with respect to the optimum yield from each fishery (16 U.S.C. 1852(h)).

The Council has developed a management policy and objectives to guide its development of management recommendations to the Secretary of Commerce for the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries. This management approach is described in Section 2.2.

2.1 National Standards for Fishery Conservation and Management

The Magnuson-Stevens Act, as amended, sets out ten national standards for fishery conservation and management (16 U.S.C. § 1851), with which all fishery management plans must be consistent.

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
2. Conservation and management measures shall be based upon the best scientific information available.
3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.
4. Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be A) fair and equitable to all such fishermen; B) reasonably calculated to promote conservation; and C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
5. Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

7. Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to A) provide for the sustained participation of such communities, and B) to the extent practicable, minimize adverse economic impacts on such communities.

9. Conservation and management measures shall, to the extent practicable, A) minimize bycatch and B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

10. Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

2.2 Management Approach for the BSAI Groundfish Fisheries

The Council's policy is to apply judicious and responsible fisheries management practices, based on sound scientific research and analysis, proactively rather than reactively, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future, as well as current generations. The productivity of the North Pacific ecosystem is acknowledged to be among the highest in the world. For the past 25 years, the Council management approach has incorporated forward looking conservation measures that address differing levels of uncertainty. This management approach has in recent years been labeled the precautionary approach. Recognizing that potential changes in productivity may be caused by fluctuations in natural oceanographic conditions, fisheries, and other, non-fishing activities, the Council intends to continue to take appropriate measures to insure the continued sustainability of the managed species. It will carry out this objective by considering reasonable, adaptive management measures, as described in the Magnuson-Stevens Act and in conformance with the National Standards, the Endangered Species Act (ESA), the National Environmental Policy Act, and other applicable law. This management approach takes into account the National Academy of Science's recommendations on Sustainable Fisheries Policy.

As part of its policy, the Council intends to consider and adopt, as appropriate, measures that accelerate the Council's precautionary, adaptive management approach through community-based or rights-based management, ecosystem-based management principles that protect managed species from overfishing, and where appropriate and practicable, increase habitat protection and bycatch constraints. All management measures will be based on the best scientific information available. Given this intent, the fishery management goal is to provide sound conservation of the living marine resources; provide socially and economically viable fisheries for the well-being of fishing communities; minimize human-caused threats to protected species; maintain a healthy marine resource habitat; and incorporate ecosystem-based considerations into management decisions.

This management approach recognizes the need to balance many competing uses of marine resources and different social and economic goals for sustainable fishery management, including protection of the long-term health of the resource and the optimization of yield. This policy will use and improve upon the Council's existing open and transparent process of public involvement in decision-making.

2.2.1 Management Objectives

Adaptive management requires regular and periodic review. Objectives identified in this policy statement will be reviewed annually by the Council. The Council will also review, modify, eliminate, or consider new issues, as appropriate, to best carry out the goals and objectives of this management policy.

To meet the goals of this overall management approach, the Council and NMFS will use the Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (PSEIS) (NMFS 2004) as a planning document. To help focus consideration of potential management measures, the Council and NMFS will use the following objectives as guideposts, to be re-evaluated, as amendments to the FMP are considered over the life of the PSEIS.

Prevent Overfishing:

1. Adopt conservative harvest levels for multi-species and single species fisheries and specify optimum yield.
2. Continue to use the existing optimum yield cap for the BSAI (as stated in current law) groundfish fisheries.
3. Provide for adaptive management by continuing to specify optimum yield as a range.
4. Initiate a scientific review of the adequacy of F_{40} and adopt improvements, as appropriate.
5. Continue to improve the management of species through species categories.

Promote Sustainable Fisheries and Communities:

6. Promote conservation while providing for optimum yield in terms of the greatest overall benefit to the nation with particular reference to food production, and sustainable opportunities for recreational, subsistence, and commercial fishing participants and fishing communities.
7. Promote management measures that, while meeting conservation objectives, are also designed to avoid significant disruption of existing social and economic structures.
8. Promote fair and equitable allocation of identified available resources in a manner such that no particular sector, group or entity acquires an excessive share of the privileges.
9. Promote increased safety at sea.

Preserve Food Web:

10. Develop indices of ecosystem health as targets for management.
11. Improve the procedure to adjust acceptable biological catch levels as necessary to account for uncertainty and ecosystem factors.
12. Continue to protect the integrity of the food web through limits on harvest of forage species.
13. Incorporate ecosystem-based considerations into fishery management decisions, as appropriate.

Manage Incidental Catch and Reduce Bycatch and Waste:

14. Continue and improve current incidental catch and bycatch management program.

15. Develop incentive programs for bycatch reduction including the development of mechanisms to facilitate the formation of bycatch pools, vessel bycatch allowances, or other bycatch incentive systems.
16. Encourage research programs to evaluate current population estimates for non-target species with a view to setting appropriate bycatch limits, as information becomes available.
17. Continue program to reduce discards by developing management measures that encourage the use of gear and fishing techniques that reduce bycatch which includes economic discards.
18. Continue to manage incidental catch and bycatch through seasonal distribution of total allowable catch and geographical gear restrictions.
19. Continue to account for bycatch mortality in total allowable catch accounting and improve the accuracy of mortality assessments for target, prohibited species catch, and non-commercial species.
20. Control the bycatch of prohibited species through prohibited species catch limits or other appropriate measures.
21. Reduce waste to biologically and socially acceptable levels.

Avoid Impacts to Seabirds and Marine Mammals:

22. Continue to cooperate with U.S. Fish and Wildlife Service (USFWS) to protect ESA-listed species, and if appropriate and practicable, other seabird species.
23. Maintain or adjust current protection measures as appropriate to avoid jeopardy of extinction or adverse modification to critical habitat for ESA-listed Steller sea lions.
24. Encourage programs to review status of endangered or threatened marine mammal stocks and fishing interactions and develop fishery management measures as appropriate.
25. Continue to cooperate with NMFS and USFWS to protect ESA-listed marine mammal species, and if appropriate and practicable, other marine mammal species.

Reduce and Avoid Impacts to Habitat:

26. Review and evaluate efficacy of existing habitat protection measures for managed species.
27. Identify and designate essential fish habitat and habitat areas of particular concern pursuant to Magnuson-Stevens Act rules, and mitigate fishery impacts as necessary and practicable to continue the sustainability of managed species.
28. Develop a Marine Protected Area policy in coordination with national and state policies.
29. Encourage development of a research program to identify regional baseline habitat information and mapping, subject to funding and staff availability.
30. Develop goals, objectives and criteria to evaluate the efficacy and suitable design of marine protected areas and no-take marine reserves as tools to maintain abundance, diversity, and productivity. Implement marine protected areas if and where appropriate.

Promote Equitable and Efficient Use of Fishery Resources:

31. Provide economic and community stability to harvesting and processing sectors through fair allocation of fishery resources.

32. Maintain the license limitation program, modified as necessary, and further decrease excess fishing capacity and overcapitalization by eliminating latent licences and extending programs such as community or rights-based management to some or all groundfish fisheries.
33. Provide for adaptive management by periodically evaluating the effectiveness of rationalization programs and the allocation of access rights based on performance.
34. Develop management measures that, when practicable, consider the efficient use of fishery resources taking into account the interest of harvesters, processors, and communities.

Increase Alaska Native Consultation:

35. Continue to incorporate local and traditional knowledge in fishery management.
36. Consider ways to enhance collection of local and traditional knowledge from communities, and incorporate such knowledge in fishery management where appropriate.
37. Increase Alaska Native participation and consultation in fishery management.

Improve Data Quality, Monitoring and Enforcement:

38. Increase the utility of groundfish fishery observer data for the conservation and management of living marine resources.
39. Improve the North Pacific Groundfish Observer Program, and consider ways to address the disproportionate costs associated with the current funding mechanism.
40. Improve community and regional economic impact costs and benefits through increased data reporting requirements.
41. Increase the quality of monitoring and enforcement data through improved technology.
42. Encourage a coordinated, long-term ecosystem monitoring program to collect baseline information and compile existing information from a variety of ongoing research initiatives, subject to funding and staff availability.
43. Cooperate with research institutions such as the North Pacific Research Board in identifying research needs to address pressing fishery issues.
44. Promote enhanced enforceability.
45. Continue to cooperate and coordinate management and enforcement programs with the Alaska Board of Fish, Alaska Department of Fish and Game, and Alaska Fish and Wildlife Protection, the U.S. Coast Guard, NMFS Enforcement, International Pacific Halibut Commission, Federal agencies, and other organizations to meet conservation requirements; promote economically healthy and sustainable fisheries and fishing communities; and maximize efficiencies in management and enforcement programs through continued consultation, coordination, and cooperation.

Chapter 3 Conservation and Management Measures

The Fishery Management Plan (FMP) for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI) authorizes the commercial harvest of species listed in Section 3.1 of this FMP. Commercial fishing is authorized during the fishing year unless otherwise specified in the FMP. Section 3.2 describes the procedures for determining harvest levels for the groundfish species. Sections 3.3 to 3.6 address permit and participation, authorized gear, time and area, and catch restrictions, respectively. Section 3.7 describes the specific management measures for the fixed gear sablefish quota share program. Measures that allow flexible management authority are addressed in Section 3.8. Section 3.9 designates monitoring and reporting requirements for the fisheries. Section 3.10 describes the schedule and procedures for review of the FMP or FMP components.

The groundfish resources off Alaska have been harvested and processed entirely by U.S.-flagged vessels since 1991. Conservation and management measures contained in this FMP apply exclusively to domestic fishing activities. No portion of the annual optimum yield is allocated to foreign harvesters or foreign processors.

3.1 Areas and Stocks Involved

The FMP and its management regime governs fishing by United States (U.S.) vessels in the Bering Sea and Aleutian Islands management area described in Section 3.1.1, and for those stocks listed in Section 3.1.2. Fishing for groundfish by foreign vessels is not permitted in the BSAI.

3.1.1 Management Area

The BSAI management area encompasses the U.S. Exclusive Economic Zone (EEZ) of the eastern Bering Sea and that portion of the North Pacific Ocean adjacent to the Aleutian Islands west of 170° W. longitude (Figure 1-1). The northern boundary of the Bering Sea is the Bering Strait, defined as a straight line from Cape Prince of Whales to Cape Dezhneva, Russia.

The FMP area is divided into two fishing areas, the Bering Sea subarea and the Aleutian Islands subarea. The Bering Sea subarea includes a defined area known as the Bogoslof District. For the purpose of spatially allocating total allowable catch, the Aleutian Islands subarea is divided into three districts, the eastern district (between 170° and 177° W. longitude), the central district (between 177° W. longitude and 177° E. longitude), and the western district (west of 177° E longitude).

The subareas and districts of the BSAI management area are illustrated in Figure 3-1. Geographical coordinates for these areas are described in Appendix B.

Figure 3-1 Subareas and districts of the Bering Sea and Aleutian Islands management area.

[PLACEHOLDER]

3.1.2 Stocks

Stocks governed by the FMP are listed in Table 3-1, and include 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 Section 3.1.1.

Five 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 Table 3-1 and are described as follows:

1. Prohibited Species – are those species and species groups the catch of which must be avoided while fishing for groundfish, and which must be returned to sea with a minimum of injury except when their retention is authorized by other applicable law (see also Prohibited Species Donation Program described in Section 3.6.1.1). Groundfish species and species groups under the FMP for which the quotas have been achieved shall be treated in the same manner as prohibited species.

2. Target species – are those species that support either a single species or mixed species target fishery, 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, sablefish, yellowfin sole, Greenland turbot, arrowtooth flounder, rock sole, flathead sole, Alaska plaice, "other flatfish", Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, "other rockfish", Atka mackerel, and squid.

3. Other Species – are those species or species groups that 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 insufficient data exist to allow separate management. 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, and octopus.

4. Forage fish species – are those species, listed in Table 3-1, which are a critical food source for many marine mammal, seabird and fish species. The forage fish species category is established to allow for the management of these species in a manner that prevents the development of a commercial directed fishery for forage fish. Management measures for this species category will be specified in regulations and may include such measures as prohibitions on directed fishing, limitations on allowable bycatch retention amounts, or limitations on the sale, barter, trade or any other commercial exchange, as well as the processing of forage fish in a commercial processing facility.

5. 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, but are not limited to, those listed in Table 3-1. Virtually no data exist which would allow population assessments. No record of catch is necessary. The allowable catch for this category is the amount which is taken incidentally while fishing for target and other species, whether retained or discarded.

Table 3-1 Species included in the FMP species categories

	Finfish	Marine Invertebrates
Prohibited Species[1]	Pacific halibut Pacific herring Pacific salmon Steelhead	King crab Tanner crab
Target Species[2]	Walleye pollock Pacific cod Sablefish Yellowfin sole Greenland turbot Arrowtooth flounder Rock sole Flathead sole Alaska plaice Other flatfish Pacific ocean perch Northern rockfish Shortraker rockfish Rougheye rockfish Other rockfish Atka mackerel	Squid
Other Species[3]	Sculpins Sharks Skates	Octopus
Forage Fish Species[4]	Osmeridae family (eulachon, capelin, and other smelts) Myctophidae family (lanternfishes) Bathylagidae family (deep-sea smelts) Ammodytidae family (Pacific sand lance) Trichodontidae family (Pacific sand fish) Pholidae family (gunnels) Stichaeidae family (pricklebacks, warbonnets, eelblennys, cockscombs, and shannys) Gonostomatidae family (bristlemouths, lightfishes, and anglemouths)	Order Euphausiacea (krill)

[1]Must be returned to the sea
[2]TAC for each listing
[3]Aggregate TAC for group
[4]Management measures for forage fish are established in regulations implementing the FMP

3.2 Determining Harvest Levels

This section of the FMP provides the basis for determining harvest levels in the groundfish fisheries. Section 3.2.1 defines terms used in the harvest specification process. The maximum sustainable yield and optimum yield of groundfish in the Bering Sea and Aleutian Islands are addressed in Sections 3.2.2 and 3.2.3. Criteria for determining overfishing are described in Section 3.2.4, followed by the procedures for setting total allowable catch in Section 3.2.5. Section 3.2.6 specifies those groundfish fisheries for which the total allowable catch is apportioned by gear type, area, or season.

The Council harvest strategy was reviewed in 2002 by Goodman *et al.*.The report contains a historical overview of the Council's approach to fishery harvest management, and an analysis of single-species, multispecies and ecosystem issues relating to the harvest strategy. The report is available by request from the Council office.

3.2.1 Definition of Terms

Maximum sustainable yield (MSY) is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions.

Optimum yield (OY) is the amount of fish which–

a) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;
b) is prescribed as such on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and
c) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery.

Overfishing level (OFL) is a limit reference point set annually for a stock or stock complex during the assessment process, as described in Section 3.2.4, Overfishing criteria. Overfishing occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. Operationally, overfishing occurs when the harvest exceeds the OFL.

Acceptable biological catch (ABC) is an annual sustainable target harvest (or range of harvests) for a stock or stock complex, determined by the Plan Team and the Science and Statistical Committee during the assessment process. It is derived from the status and dynamics of the stock, environmental conditions, and other ecological factors, given the prevailing technological characteristics of the fishery. The target reference point is set below the limit reference point for overfishing.

Total allowable catch (TAC) is the annual harvest limit for a stock or stock complex, derived from the ABC by considering social and economic factors.

In addition to definitional differences, OY differs from ABC and TAC in two practical respects. First, ABC and TAC are specified for each stock or stock complex within the "target species" and "other species" categories, whereas OY is specified for the groundfish fishery (comprising target sepcies and other species categories) as a whole. Second, ABCs and TACs are specified annually whereas the OY range is constant. The sum of the stock-specific ABCs may fall within or outside of the OY range. If the sum of annual TACs falls outside the OY range, TACs must be adjusted or the FMP amended.

3.2.2 Maximum Sustainable Yield of the Groundfish Complex

The groundfish complex and its fishery are a distinct management unit of the Bering Sea. 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. Ideally, concepts such as productivity and MSY should be viewed in terms of the groundfish complex as a unit rather than for individual species or species groups. Due to the difficulty of estimating the parameters that govern interactions between species, however, estimates of MSY for the groundfish complex have sometimes been computed by summing MSY estimates for the individual species and species groups.

Early studies estimated MSY for the groundfish complex in the range of 1.7 to 2.4 million mt. This range was obtained by summing the MSY ranges for each target species and the "other species" category, as defined in Section 3.2.2 of this plan. By way of comparison, this range included both the average annual

catch (1.8 million mt) and the maximum annual catch (2.4 million mt) taken during the period 1968-1977 (see Section 4.3.1, History of Exploitation). However, current multi-species models suggest that the sum of single-species MSYs provides a poor estimate of MSY for the groundfish complex as a whole (Walters et al., in press) because biological reference points for single stocks, such as F_{MSY}, may change substantially when multi-species interactions are taken into account (Gislason 1999; Collie and Gislason 2001). Fishing mortality rates for prey species that are consumed by other marine predators should be conditioned on the level of predation mortality, which may change over time depending on predator population levels.

An ecosystem perspective suggests that the MSY of the groundfish complex may change if an environmental regime shift occurs or if the present mix of species is altered substantially. Also, as new data are acquired and as statistical methodology evolves over time, it is to be expected that estimates of MSY will change, even if the ecosystem has remained relatively stationary. Therefore, estimates of MSY contained in this section should be viewed in context, as historical estimates that guided development of the FMP but not necessarily as reflective of the best scientific information available currently.

3.2.3 Optimum Yield of the Groundfish Complex

The optimum yield of the groundfish complex is specified as 85% of the historical estimate of the MSY range 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 the historical estimate of MSY reflects the combined influence of ecological, social, and economic factors. The important ecological factors may be summarized as follows:

- The OY range encompasses the summed ABCs of individual species for 1978-1981 (Low, et al. 1978; and Bakkala, et al. 1979, 1980, and 1981). This sum was used as an indicator of the biological productivity of the complex, although such use is not completely satisfactory because multi-species/ecosystem interactions are not taken into account explicitly. The 15% reduction from MSY reduces the risk associated with incomplete data and questionable assumptions in assessment models used to determine the condition of stocks.

The important social and economic factors may be summarized as follows:

1. The OY range is not likely to have any significant detrimental impact on the industry. On the contrary, specification of OY as a constant range helps to create a stable management environment in which the industry can plan its activities consistently, with an expectation that each year’s total groundfish catch will be at least 1.4 million metric tons.

2. The OY range encompasses the annual catch levels taken in the period immediately prior to its implementation, during which the fishery operated profitably.

OY may need to be respecified in the future if major changes occur in the estimate of MSY for the groundfish complex. Likewise, OY may need to be respecified if major changes occur in the ecological, social, or economic factors governing the relationship between OY and MSY.

3.2.4 Overfishing Criteria

Overfishing is defined as any amount of fishing in excess of a prescribed maximum allowable rate. This maximum allowable rate is prescribed through a set of six tiers which are listed below in descending order

of preference, corresponding to descending order of information availability. The Council's Science and Statistical Committee (SSC) will have final authority for determining whether a given item of information is "reliable" for the purpose of this definition, and may use either objective or subjective criteria in making such determinations.

For tier (1), a "pdf" refers to a probability density function. For tiers 1 and 2, if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For tiers 1 to 5, if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For tiers 1 to 3, the coefficient α is set at a default value of 0.05. This default value was established by applying the 10% rule suggested by Rosenberg et al. (1994) to the 1/2 B_{MSY} reference point. However, the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers 2 to 4, a designation of the form "$F_{X\%}$" refers to the fishing mortality rate (F) associated with an equilibrium level of spawning per recruit equal to $X\%$ of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view spawning per recruit calculations based on a knife-edge maturity assumption as reliable. For tier 3, the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

Tier 1 Information available: Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.

1a) Stock status: $B/B_{MSY} > 1$
$F_{OFL} = m_A$, the arithmetic mean of the pdf
$F_{ABC} \leq m_H$, the harmonic mean of the pdf

1b) Stock status: $a < B/B_{MSY} \leq 1$
$F_{OFL} = m_A \times (B/B_{MSY} - a)/(1 - a)$
$F_{ABC} \leq m_H \times (B/B_{MSY} - a)/(1 - a)$

1c) Stock status: $B/B_{MSY} \leq a$
$F_{OFL} = 0$
$F_{ABC} = 0$

Tier 2 Information available: Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.

2a) Stock status: $B/B_{MSY} > 1$
$F_{OFL} = F_{MSY}$
$F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$

2b) Stock status: $a < B/B_{MSY} \leq 1$
$F_{OFL} = F_{MSY} \times (B/B_{MSY} - a)/(1 - a)$
$F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - a)/(1 - a)$

2c) Stock status: $B/B_{MSY} \leq a$
$F_{OFL} = 0$
$F_{ABC} = 0$

Tier 3 Information available: Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.

3a) Stock status: $B/B_{40\%} > 1$
$F_{OFL} = F_{35\%}$
$F_{ABC} \leq F_{40\%}$

3b) Stock status: $a < B/B_{40\%} \leq 1$
$F_{OFL} = F_{35\%} \times (B/B_{40\%} - a)/(1 - a)$
$F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - a)/(1 - a)$

3c) Stock status: $B/B_{40\%} \leq a$
$F_{OFL} = 0$
$F_{ABC} = 0$

Tier 4 Information available: Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.

$F_{OFL} = F_{35\%}$

$F_{ABC} \leq F_{40\%}$

Tier 5 Information available: Reliable point estimates of B and natural mortality rate M.

$F_{OFL} = M$

$F_{ABC} \leq 0.75 \times M$

Tier 6 Information available: Reliable catch history from 1978 through 1995.

OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information

ABC $\leq$ 0.75 × OFL

3.2.5 Procedures for Setting Total Allowable Catch

The Secretary, after receiving recommendations from the Council, will determine up to 2 years of TACs and apportionments thereof, and reserves for each stock or stock complex in the "target species" and "other species" categories, by January 1 of the new fishing year, or as soon as practicable thereafter, by means of regulations implementing the FMP. Notwithstanding designated stocks or stock complexes listed by category in Table 3-1, the Council may recommend splitting or combining stocks or stock complexes in the "target species" category for purposes of establishing a new TAC if such action is desirable based on commercial importance of a stock or stock complex and whether sufficient biological information is available to manage a stock or stock complex on its own merits.

Prior to making final recommendations to the Secretary, the Council will make available to the public for comment as soon as practicable after its October meeting, proposed specifications of ABC and TAC for each target stock or stock complex and the "other species" category, and apportionments thereof, and reserves.

The Council will provide proposed recommendations for harvest specifications to the Secretary after its October meeting, including detailed information on the development of each proposed specification and any future information that is expected to affect the final specifications. As soon as practicable after the October meeting, the Secretary will publish in the *Federal Register* proposed harvest specifications based on the Council's October recommendations and make available for public review and comment, all information regarding the development of the specifications, identifying specifications that are likely to change, and possible reasons for changes, if known, from the proposed to final specifications. The prior public review and comment period on the published proposed specifications will be a minimum of 15 days.

At its December meeting, the Council will review the final SAFE reports, recommendations from the Groundfish Plan teams, SSC, AP, and comments received. The Council will then make final harvest specifications recommendations to the Secretary for review, approval, and publication. New final annual specifications will supercede current annual specifications on the effective date of the new annual specifications.

3.2.5.1 Framework for Setting Total Allowable Catch

A procedure has been developed whereby the Council may set annual harvest levels by specifying a total allowable catch for each groundfish fishery on an annual basis. The procedure is used to determine TACs for every groundfish species and species group managed by the FMP.

Scientists from the Alaska Fisheries Science Center, the Alaska Department of Fish and Game, and other agencies and universities prepare *Stock Assessment and Fishery Evaluation* (SAFE) documents annually (see Section 3.2.5.2 for further information). These documents are first reviewed by the Groundfish Plan Team, and then by the Council's SSC and AP, and the Council. Reference point recommendations are made at each level of assessment. Usually, scientists recommend values for ABC and OFL, and the AP recommends values for TAC. The Council has final authority to approve all reference points, but focuses on setting TACs so that OY is achieved and OFLs are not exceeded.

The procedure for setting TAC consists of the following steps:

1. Determine the ABC for each managed species or species group. ABCs are recommended by the Council's SSC based on information presented by the Plan Team.
2. Determine a TAC based on biological and socioeconomic information. The TAC may be lower than the ABC if bycatch considerations or socioeconomic considerations cause the Council to establish a lower harvest.
3. Sum TACs for "target species" and "other species" to assure that the sum is within the optimum yield range specified for the groundfish complex in the FMP. If the sum falls outside this range the TACs must be adjusted or the FMP amended.

3.2.5.2 Stock Assessment and Fishery Evaluation

For purposes of supplying scientific information to the Council for use in specifying TACs, a SAFE report is prepared annually.

The SAFE report will, at a minimum, contain or refer to the following:

1. current status of BSAI area groundfish resources, by major species or species group;
2. estimates of maximum sustainable yield and acceptable biological catch;
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 for prohibited species with supporting justification and rationale (further detail in Section 3.6.2.3.2); and
8. any other biological, social, or economic information that may be useful to the Council.

3.2.5.3 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 TACs, except for pollock and fixed-gear sablefish. When the TACs for the groundfish complex are determined by the Council, 15% of the sum of the TACs is set aside as a reserve. This reserve is used for: a) correction of operational problems in the fishing fleets, to promote full

and efficient use of groundfish resources, b) adjustments of species TACs according to the condition of stocks during the fishing year, and c) apportionments.

The reserve is not designated by species or species groups and will be apportioned to the fisheries during the fishing year by the Regional Administrator in amounts and by species that s/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 Administrator finds that the socioeconomic considerations listed above or specified fishery operational problems dictate otherwise. Except as provided for in the National Standard Guidelines, the Regional Administrator must also find that the apportionment of reserves will not result in overfishing as defined in the guidelines. The Regional Administrator may withhold reserves for conservation reasons.

3.2.6 Apportionment of Total Allowable Catch

When the TAC for each target species and the "other species" category, except for pollock and fixed-gear sablefish, is determined, it is reduced by 15% to form the reserve, as described in Section 3.2.5.2. The remaining 85% of each TAC is then apportioned by the Regional Administrator.

Groundfish species and species groups under the FMP for which TAC has been achieved shall be treated in the same manner as prohibited species; they must be returned to the sea with a minimum of injury.

3.2.6.1 Pollock

3.2.6.1.1 Gear Allocation

The Regional Administrator, in consultation with the Council, may limit the amount of pollock that may be taken with trawls other than pelagic trawls. Prior to the Regional Administrator's determination, the Council will recommend to him or her a limit on the amount of pollock that may be taken with other than pelagic trawl gear. The Regional Administrator shall make the Council's recommendations available to the public for comment under the annual TAC specification process set forth under Section 3.2.5.

The following information must be considered by the Council when determining whether a limit will be recommended and what that limit should be:

a. PSC limits established under Section 3.6.2;

b. projected prohibited species bycatch levels with and without a limit on the amount of pollock that may be taken with other than pelagic trawl gear;

c. the cost of the limit on the bottom-trawl and pelagic trawl fisheries; and

d. other factors that determine the effects of the limit on the attainment of FMP goals and objectives.

3.2.6.1.2 Seasonal Allocation

The pollock TAC shall be divided into two allowances: roe-bearing ("A" season) and non-roe-bearing ("B" season). 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.

3.2.6.2 Sablefish

Sablefish in the Bering Sea subarea

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.

Sablefish in the Aleutian Islands subarea

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.

3.2.6.3 Pacific Cod

3.2.6.3.1 Gear Allocations

Among gear groups

The BSAI Pacific cod TAC shall be allocated among gear groups as follows: 2% to vessels using jig gear; 51% to vessels using hook-and-line or pot gear; and 47% to vessels using trawl gear. The trawl apportionment will be divided 50% to catcher vessels and 50% to catcher processors.

Among vessels using hook-and-line or pot gear

The Regional Administrator annually will estimate the amount of Pacific cod taken as incidental catch in directed fisheries for groundfish other than Pacific cod by vessels using hook-and-line or pot gear and deduct that amount from the portion of Pacific cod TAC annually allocated to hook-and-line or pot gear. The remainder will be further allocated as directed fishing allowances as follows:

a. 80% to catcher/processor vessels using hook-and-line gear;
b. 0.3% to catcher vessels using hook-and-line gear;
c. 3.3% to catcher/processor vessels using pot gear;
d. 15% to catcher vessels using pot gear; and
e. 1.4% to catcher vessels less than 60 ft length overall that uses either hook-and-line gear or pot gear.

Specific provisions for the accounting of these directed fishing allowances and the transfer of unharvested amounts of these allowances to other vessels using hook-and-line or pot gear will be set forth in regulations.

3.2.6.3.2 Seasonal Allocations

The amount of Pacific cod allocated to gear groups under Section 3.2.6.3.1 may be seasonally apportioned. Criteria for seasonal apportionments and the seasons authorized to receive separate apportionments will be set forth in regulations.

3.2.6.4 Atka Mackerel

The Regional Administrator, in consultation with the Council, will annually allocate up to 2% of the TAC specified for Atka mackerel in the eastern Aleutian Islands District/Bering Sea subarea to vessels using jig gear in these areas. The jig gear allocation will be specified during the annual groundfish specifications process based on recent annual catches of Atka mackerel by vessels using jig gear and the anticipated harvest of this species by the jig gear fleet during the upcoming fishing year.

3.2.6.5 Shortraker and Rougheye Rockfish

After subtraction of reserves, the Aleutian Islands subarea TAC specified for shortraker and rougheye rockfish will be allocated 70% to vessels using trawl gear and 30% to vessels using non-trawl gear.

3.3 Permit and Participation Restrictions

Certain permits are required of participants in the BSAI groundfish fisheries. The framework of the License Limitation Program (Section 3.3.1) and the experimental fishing permit program (Section 3.3.2) are set out below, however specific requirements are found in regulations implementing the FMP.

3.3.1 License Limitation Program

As of January 1, 2000, a Federal groundfish license is required for catcher vessels (including catcher/processors) participating in all BSAI groundfish fisheries, other than fixed gear sablefish. However, the following vessel categories are exempt from the license program requirements:

a. vessels fishing in State of Alaska waters (0-3 miles offshore);

b. vessels less than 32' LOA; or

c. jig gear vessels less than 60' LOA using a maximum of 5 jig machines, one line per machine, and a maximum of 15 hooks per line.

Any vessel that meets the LLP qualification requirements will be issued a license, regardless of whether they are exempt from the program or not.

3.3.1.1 Elements of the License Limitation Program

1. Nature of Licenses. General licenses will be issued for the entire BSAI management area based on historical landings defined in Federal regulations. Vessels that qualify for both a BSAI and a Gulf of Alaska general license will be issued both as a non-severable package. Area endorsements for the Bering Sea and/or Aleutian Islands subareas will be issued along with the general license. General licenses and endorsements will remain a non-severable package.

2. License Recipients. Licenses will be issued to owners (as of June 17, 1995) of qualified vessels. The owners as of this date must be “persons eligible to document a fishing vessel” under Chapter 121, Title 46, U.S.C. In cases where the vessel was sold on or before June 17, 1995, and the disposition of the vessel's fishing history for license qualification was not mentioned in the contract, the license qualification history would go with the vessel. If the transfer occurred after June 17, 1995, the license qualification history would stay with the seller of the vessel unless the contract specified otherwise.

3. License Designations. Licenses and endorsements will be designated as Catcher Vessel or Catcher Processor and with one of three vessel length classes (<60', ≥60' but < 125', or ≥ 125' LOA). Vessels less than 60' LOA with a catcher vessel designation may process up to 1 mt (round weight) of fish per day.

   General licenses will also contain a gear designation (trawl gear, non-trawl gear, or both) based on landings activity in any area through June 17, 1995. Vessels that used both trawl and non-trawl gear during the original qualification period would receive both gear designations, while vessels that used only trawl gear or only non-trawl gear during the original qualification period (general or endorsement period) would receive one or the other. For vessels that used only one gear type (trawl/non-trawl) in the original qualification period, and then used the other gear type between June 18, 1995 and February 7, 1998, the license recipient may choose one or the other gear designation, but will not receive both. For vessels that used only one gear type (trawl/non-trawl) in the original qualification period, but made a significant financial investment towards conversion to the other gear type or deployment of such gear on or before February 7, 1998, and made landings on that vessel with the new gear type by December 31, 1998, the license recipient may choose which gear designation to receive, but not both. A significant financial commitment is defined as a minimum purchase of $100,000 worth of equipment specific to trawling or having acquired groundline, hooks

or pots, and hauling equipment for the purpose of prosecuting the non-trawl fisheries on or by February 7, 1998.

4. Who May Purchase Licenses. Licenses may be transferred only to "persons" defined as those "eligible to document a fishing vessel" under Chapter 121, Title 46, U.S.C. Licenses may not be leased.

5. Vessel/License Linkages. Licenses may be transferred without a vessel, i.e., licenses may be applied to vessels other than the one to which the license was initially issued. However, the new vessel is still subject to the license designations, vessel upgrade provisions, "20% upgrade rule" (defined in provision seven), and the no leasing provision. Licenses may be applied to vessels shorter than the maximum LOA allowed by the license regardless of the vessel's length designation. Vessels may also use catcher processor licenses on catcher vessels. However, the reverse is not allowed.

   Notwithstanding the above, licenses earned on vessels that did not hold a Federal fisheries permit prior to October 9, 1998, may be transferred only if the vessel originally assigned the license is transferred along with the license, unless a fishing history transfer occurred prior to February 7, 1998, in which case the vessel does not have to accompany the license earned from that fishing history; however, any future transfer of that license would have to include that vessel.

6. Separability of General Licenses and Endorsements. General licenses may be issued for the BSAI groundfish, Gulf of Alaska groundfish, and Bering Sea and Aleutian Islands crab fisheries. Those general licenses initially issued to a person based on a particular vessel's catch history are not separable and shall remain as a single "package". General licenses transferred after initial allocation shall remain separate "packages" in the form they were initially issued, and will not be combined with other general groundfish or crab licenses the person may own. Area endorsements are not separable from the general license they are initially issued under, and shall remain as a single "package", which includes the assigned catcher vessel/catcher processor and length designations.

7. Vessel Replacements and Upgrades. Vessels may be replaced or upgraded within the bounds of the vessel length designations and the "20% rule". This rule was originally defined for the vessel moratorium program. The maximum LOA with respect to a vessel means the greatest LOA of that vessel or its replacement that may qualify it to conduct directed fishing for groundfish covered under the license program, except as provided at § 679.4(d). The maximum LOA of a vessel with license qualification will be determined by the Regional Administrator as follows:

   a. For a vessel with license qualification that is less than 125' LOA, the maximum LOA will be equal to 1.2 times the vessel's original qualifying length or 125', whichever is less; and

   b. For a vessel with license qualification that is equal to or greater that 125', the maximum LOA will be equal to the vessel's original qualifying length.

   If a vessel upgrades under the "20% rule" to a length which falls into a larger license length designation after June 17, 1995, then the vessel owner would be initially allocated a license and endorsement(s) based on the vessels June 17, 1995, length. Those licenses and endorsements could not be used on the qualifying vessel, and the owner would be required to obtain a license for that vessel's designation before it could be fished.

8. License Ownership Caps. No more than 10 general groundfish licenses may be purchased or controlled by a "person", with grandfather rights to those persons who exceed this limit in the initial allocation. Persons with grandfather rights from the initial allocation must be under the 10 general license cap before they will be allowed to purchase any additional licenses. A "person" is defined as those eligible to document a fishing vessel under Chapter 121, Title 46, U.S.C. For corporations, the cap would apply to the corporation and not to share holders within the corporation.

9. Vessel License Use Caps. There is no limit on the number of licenses (or endorsements) that may be used on a vessel.

10. Changing Vessel Designations. If a vessel qualifies as a catcher processor, it may select a one time (permanent) conversion to a catcher vessel designation.

11. Implement a Skipper Reporting System. NMFS will implement a skipper reporting system that requires groundfish license holders to report skipper names, addresses, and service records.

12. Vessels Targeting Non-groundfish Species. Vessels targeting non-groundfish species that are allowed to land incidentally taken groundfish species without a Federal permit before implementation of the groundfish license program, will be allowed to continue to land bycatch amounts of groundfish without having a valid groundfish license. Additionally, vessels targeting sablefish and halibut under the IFQ program will continue to be allowed to retain bycatch amounts of groundfish species.

13. CDQ Vessel Exemption. Vessels < 125' LOA obtained under an approved CDQ plan to participate in both CDQ and non-CDQ fisheries will be allowed to continue to fish both fisheries without a license, provided such vessel was under construction or operating in an existing community development plan as of October 9, 1998. If the vessel is sold outside the CDQ plan, the vessel will no longer be exempt from the rules of the license program.

14. Lost Vessels. Vessels that qualified for the moratorium and were lost, damaged, or otherwise out of the fishery due to factors beyond the control of the owner and which were replaced or otherwise reentered the fishery in accordance with the moratorium rules, and which made a landing any time between the time the vessel left the fishery and June 17, 1995, will be qualified for a general license and endorsement for that area.

15. Licenses Represent a Use Privilege. The Council may alter or rescind this program without compensation to license holders; further, licenses may be suspended or revoked for (serious and/or multiple) violations of fisheries regulations.

3.3.1.2 Species and Gear Endorsements for Vessels Using Hook-and-line and Pot Gear

Vessels engaged in directed fishing for Pacific cod in the BSAI management area using hook-and-line and/or pot gear must qualify for a Pacific cod endorsement in addition to holding an area endorsement and general license. The following criteria apply to specific gear types and vessel classes:

- Hook-and-line catcher processors. Must have made at least 270 mt of landings in the directed commercial BSAI Pacific cod fishery (excluding discards) in any one of the years 1996, 1997, 1998, or 1999.
- Hook-and-line catcher vessels ≥60 ft LOA. Must have made at least 7.5 mt of cod landings in the directed commercial BSAI Pacific cod fishery (excluding discards) in any one of the years 1995, 1996, 1997, 1998, or 1999.
- Pot catcher/processors. Must have made at least 300,000 lbs of landings in the directed commercial BSAI Pacific cod fishery (excluding discards) in each of any two of the years 1995, 1996, 1997, or 1998.
- Pot catcher vessels ≥60 ft LOA. Must have made over 100,000 lbs of landings in the directed commercial BSAI Pacific cod fishery (excluding discards) in each of any two of the years 1995, 1996, 1997, 1998, or 1999.

Other Pacific cod endorsement requirements under the License Limitation Program apply as follows:

1. Harvest of CDQ Pacific cod. CDQ vessels shall not be exempt from the Pacific cod endorsements.
2. Vessels Earning Multiple Pacific Cod Endorsements. Vessels that qualify for a Pacific cod endorsement in more than one gear sector shall be issued an endorsement for each sector for which they qualify. Endorsements that are earned by a vessel shall be attached to that vessel's general license. The Pacific cod endorsement(s) shall not be severable from a general license, just as area endorsements are non-severable.
3. Vessels class exemptions. Vessels less than or equal to 32' LOA are exempt from the BSAI license limitation program and Pacific cod endorsements. Catcher vessels less than 60' LOA are exempt from the Pacific cod endorsements but are required to hold a general license.
4. Bait landings. Properly documented (Alaska Department of Fish and Game fishticket) commercial bait landings will count towards the landing requirements for a Pacific cod endorsement. A Pacific cod endorsement is required to fish Pacific cod in the commercial bait fishery. A Pacific cod endorsement is not required to fish Pacific cod for personal use bait.

Specific hardship and grandfather provisions will be set forth in regulations.

3.3.2 Exempted Permits

The Regional Administrator, after consulting with the Director of the Alaska Fisheries Science Center and with the Council, may authorize for limited experimental purposes, the target or incidental harvest of groundfish that would otherwise be prohibited. Exempted fishing permits might be issued for fishing in areas closed to directed fishing, for continued fishing with gear otherwise prohibited, or for continued fishing for species for which the quota has been reached. Exempted fishing permits will be issued by means of procedures contained in regulations.

As well as other information required by regulations, each application for an exempted fishing permit must provide the following information: 1) experimental design (e.g., staffing and sampling procedures, the data and samples to be collected, and analysis of the data and samples), 2) provision for public release of all obtained information, and 3) submission of interim and final reports.

The Regional Administrator may deny an exempted fishing permit for reasons contained in regulations, including a finding that:

a. according to the best scientific information available, the harvest to be conducted under the permit would detrimentally affect living marine resources, including marine mammals and birds, and their habitat in a significant way;
b. issuance of the exempted fishing permit would inequitably allocate fishing privileges among domestic fishermen or would have economic allocation as its sole purpose;
c. activities to be conducted under the exempted fishing permit would be inconsistent with the intent of the management objectives of the FMP;
d. the applicant has failed to demonstrate a valid justification for the permit;

e. the activity proposed under the exempted fishing permit could create a significant enforcement problem; or

f. the applicant failed to make available to the public information that had been obtained under a previously issued exempted fishing permit.

3.4 Gear Restrictions

3.4.1 Authorized Gear

Gear types authorized by the FMP are trawls, hook-and-line, pots, jigs, and other gear as defined in regulations. Further restrictions on gear which 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 679. Additional gear limitations by specific target fishery are described in Section 3.4.2.

3.4.2 Target Fishery-Specific

Pollock

The use of nonpelagic trawl gear in the directed fishery for pollock is prohibited.

3.5 Time and Area Restrictions

Management measures in place in the BSAI groundfish fisheries constrain fishing both temporally and spatially. In Section 3.5.1, criteria for determining fishing seasons are described. Area restrictions by gear type are described in Section 3.5.2. The FMP also authorizes the use of either temporal or spatial restrictions for marine mammal conservation, as detailed in Section 3.5.3. Section 3.5.4 addresses exemptions to the time and area restrictions in the FMP or its implementing regulations.

3.5.1 Fishing Seasons

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-Stevens 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; and
- allocation: potential allocation effects among users and indirect effects on coastal communities.

3.5.2 Area Restrictions

3.5.2.1 Trawl Gear Only

The following time and area restrictions apply to some or all trawl vessels. Other time and area restrictions that may apply to trawl vessels are triggered by the attainment of a bycatch limit. These restrictions are described in Section 3.6.2.

3.5.2.1.1 Crab and Halibut Protection Zone

The crab and halibut protection zone is closed to all trawling from January 1 to December 31. For the period March 15 to June 15, the western border of the zone extends westward. See Appendix B and Figure 3-2.

3.5.2.1.2 Pribilof Islands Habitat Conservation Area

The Pribilof Islands Habitat Conservation Area is closed to all trawling from January 1 to December 31. See Appendix B and Figure 3-3.

3.5.2.1.3 Chum Salmon Savings Area

The Chum Salmon Savings Area is closed to trawling from August 1 through August 31. See Appendix B and Figure 3-4. Trawling is also prohibited in this area upon the attainment of an ‘other salmon’ bycatch limit; see description under Section 3.6.2.

3.5.2.1.4 Red King Crab Savings Area

The Red King Crab Savings Area is closed to non-pelagic trawling year round, except that when the Regional Administrator of NMFS, in consultation with the Council, determines that a guideline harvest level for Bristol Bay red king crab has been established, he or she may open a subarea of the Red King Crab Savings Area to non-pelagic trawling. See Appendix B and Figure 3-5.

3.5.2.1.5 Nearshore Bristol Bay Trawl Closure

The Nearshore Bristol Bay area is closed to all trawling on a year round basis, except a subarea that remains open to trawling during the period April 1 to June 15 each year. See Appendix B and Figure 3-6.

3.5.2.1.6 Catcher Vessel Operational Area

Catcher/processors identified in the American Fisheries Act (see Section 3.7.2) are prohibited from engaging in directed fishing for pollock in the catcher vessel operational area (CVOA) during the non-roe season (B season), unless they are participating in a community development quota fishery (see Section 3.7.3). See Appendix B and Figure 3-7.

Figure 3-2 Crab and Halibut Protection Zone.

[PLACEHOLDER]

Figure 3-3 Pribilof Island Habitat Conservation Area.

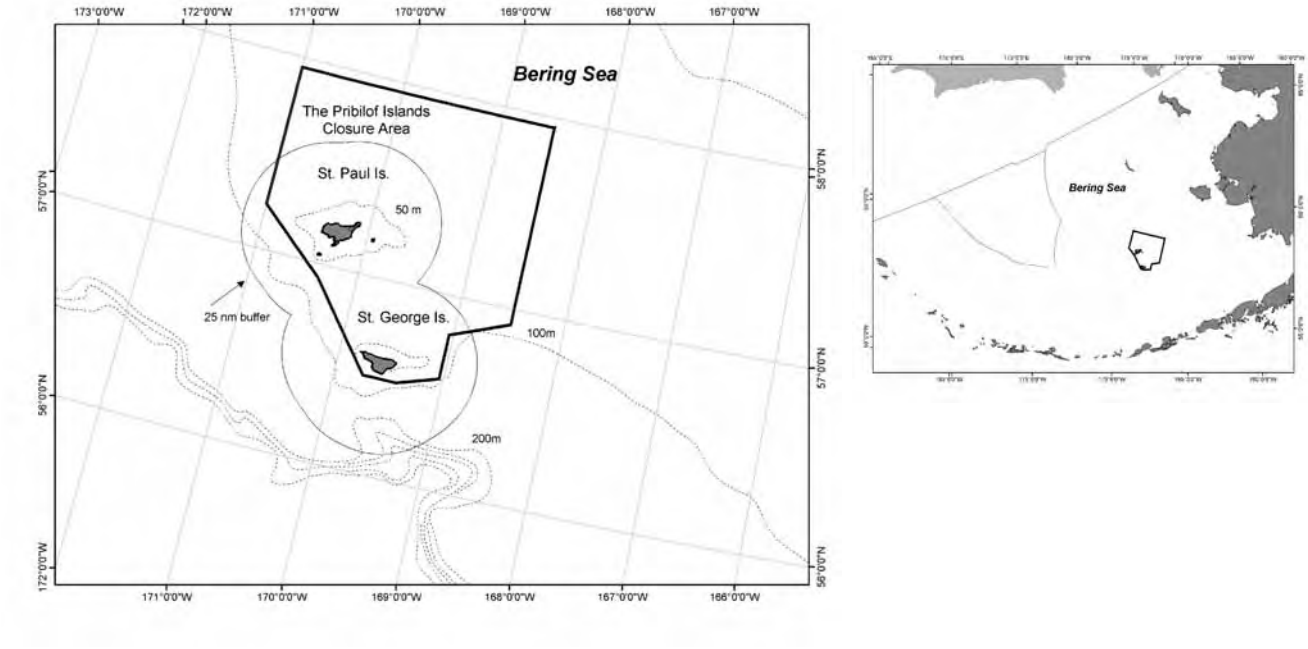


Figure 3-4 Chum Salmon Savings Area.

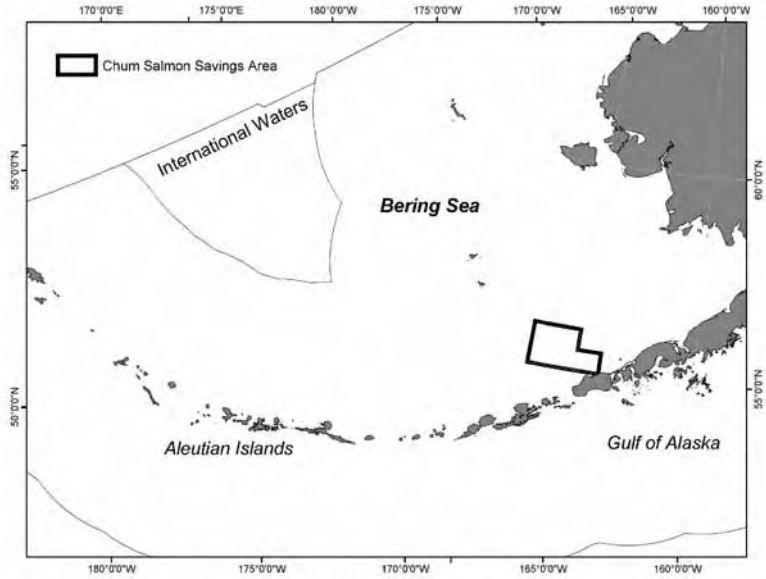


Figure 3-5 Red King Crab Savings Area.

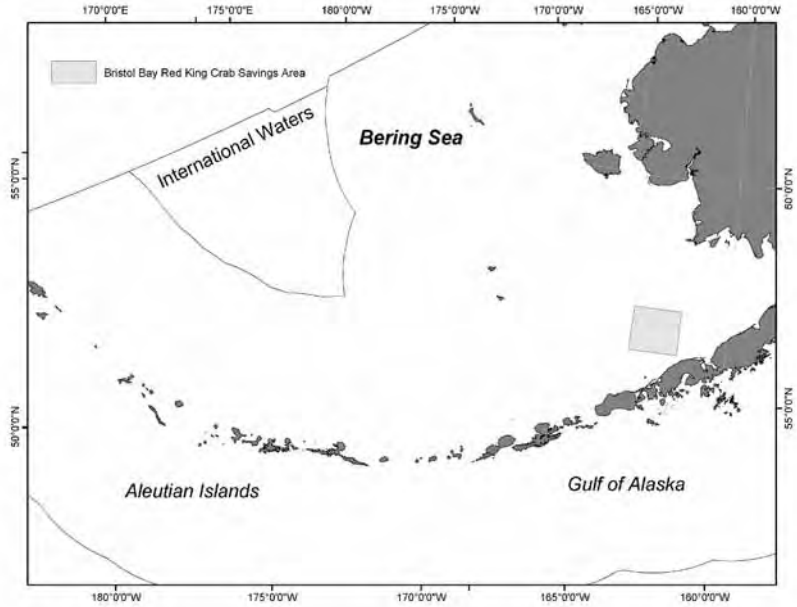


Figure 3-6 Nearshore Bristol Bay Trawl Closure.

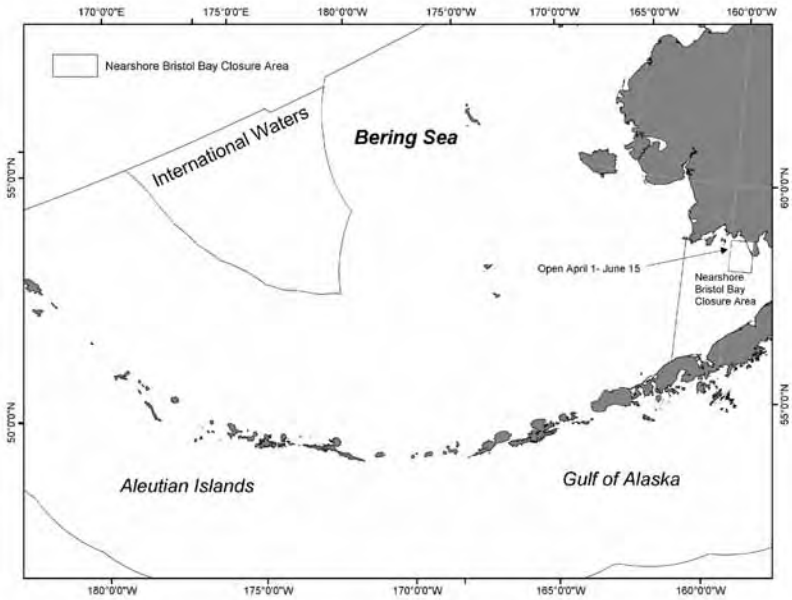


Figure 3-7 Catcher Vessel Operational Area.

[PLACEHOLDER]

3.5.3 Marine Mammal Conservation Measures

Regulations implementing the FMP may include special groundfish management measures intended to afford species of marine mammals additional protection other than that provided by other legislation. These regulations may be especially necessary when marine mammals species are reduced in abundance. Regulations may be necessary to prevent interactions between commercial fishing operations and marine mammal populations when information indicates that such interactions may adversely affect marine mammals, resulting in reduced abundance and/or reduced use of areas important to marine mammals. These areas include breeding and nursery grounds, haul out sites, and foraging areas that are important to adult and juvenile marine mammals during sensitive life stages.

Regulations intended to protect marine mammals might include those that would limit fishing effort, both temporarily and spatially, around areas important to marine mammals. Examples of temporal measures are seasonal apportionments of TAC specifications. Examples of spatial measures could be closures around areas important to marine mammals. The purpose of limiting fishing effort would be to prevent harvesting excessive amounts of the available TAC or seasonal apportionments thereof at any one time or in any one area.

3.5.4 Exemptions

The Council may promulgate regulations establishing areas where specific types of fishing gear may be tested, to be available for use when the fishing grounds are closed to that gear type. Specific gear test areas contained in regulations that implement the FMP, and changes to the regulations, will be done by regulatory amendment. These gear test areas would be established in order to provide fishermen the opportunity to

ensure that their gear is in proper working order prior to a directed fishery opening. The test areas must conform to the following conditions:

1. depth and bottom type must be suitable for testing the particular gear type;
2. must be outside State waters;
3. must be in areas not normally closed to fishing with that gear type;
4. must be in areas that are not usually fished heavily by that gear type; and
5. must not be within a designated Steller sea lion protection area at any time of the year.

3.6 Catch Restrictions

This section describes the retention and utilization restrictions for the groundfish fisheries, including prohibited species restrictions and incentive programs to reduce bycatch.

3.6.1 Prohibited Species

Pacific halibut, Pacific herring, Pacific salmon and steelhead, king crab, and Tanner crab are prohibited species and must be avoided while fishing for groundfish and must be returned to the sea with a minimum of injury except when their retention is authorized by other applicable law.

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.

3.6.1.1 Prohibited Species Donation Program

The Prohibited Species Donation Program authorizes the distribution of specified prohibited species, taken as bycatch in the groundfish trawl fisheries off Alaska, to economically disadvantaged individuals through a NMFS-authorized distributor selected by the Regional Administrator in accordance with regulations that implement the FMP. The program is limited to the following species:

1. Pacific salmon
2. Pacific halibut

3.6.2 Prohibited Species Catch Limits

When a target fishery, as specified in regulations implementing the FMP, attains a prohibited species catch (PSC) limit apportionment or seasonal allocation as described in the FMP (Section 3.6.2.1) and specified in regulations implementing the FMP, the bycatch zone(s) or management area(s) to which the PSC limit apportionment or seasonal allocation applies (described in Section 3.6.2.2) will be closed to that target fishery (or components thereof) for the remainder of the year or season, whichever is applicable. The procedure for apportioning PSC limits is detailed in Section 3.6.2.3.

3.6.2.1 Individual Species Limits

The following species have PSC limits specified either in the FMP or in regulations implementing the FMP: red king crab, *Chionoecetes bairdi*, *C. opilio*, Pacific halibut, Pacific herring, Chinook salmon, and other salmon.

3.6.2.1.1 Red King Crab

A PSC limit for red king crab in Zone 1 (as described in Section 3.6.2.2.1) is established in the following manner:

- When the number of mature female red king crab is below or equal to the threshold of 8.4 million mature crab, or the spawning biomass is less than 14.5 million lbs, the Zone 1 PSC limit will be 32,000 red king crab.

- When the number of mature female red king crab is above the threshold of 8.4 million mature crab and the effective spawning biomass is equal to or greater than 14.5 but less than 55 million lbs, the Zone 1 PSC limit will be 97,000 red king crab.

- When the number of mature female red king crab is above the threshold of 8.4 million mature crab, and the effective spawning biomass is equal to or greater than 55 million lbs, the Zone 1 PSC limit will be 197,000 red king crab.

3.6.2.1.2 *C. bairdi* Crab

The PSC limit for *C. bairdi* Tanner crab is established in regulations implementing the FMP based on their abundance as indicated by the NMFS bottom trawl survey.

3.6.2.1.3 *C. opilio* Crab

The PSC limit for *C. opilio* crab is established in regulations implementing the FMP based on their total abundance as estimated by the NMFS bottom trawl survey. Minimum and maximum PSC limits are also established in regulation.

3.6.2.1.4 Pacific Halibut

Annual BSAI-wide Pacific halibut bycatch mortality limits for trawl and non-trawl gear fisheries will be established in regulations and may be amended by regulatory amendment. When initiating a regulatory amendment to change a halibut bycatch mortality limit, the Secretary, after consultation with the Council, will consider information that includes:

1. estimated change in halibut biomass and stock condition;
2. potential impacts on halibut stocks and fisheries;
3. potential impacts on groundfish fisheries;
4. estimated bycatch mortality during prior years;
5. expected halibut bycatch mortality;

6. methods available to reduce halibut bycatch mortality;
7. the cost of reducing halibut bycatch mortality; and
8. other biological and socioeconomic factors that affect the appropriateness of a specific bycatch mortality limit in terms of FMP objectives.

3.6.2.1.5 Pacific Herring

The annual PSC limit of Pacific herring caught while conducting a trawl fishery for groundfish in the BSAI management area is one percent of the annual biomass of herring in the eastern Bering Sea.

3.6.2.1.6 Chinook Salmon

PSC limits for Chinook salmon are established for the Bering Sea and Aleutian Islands subareas in regulations implementing the FMP.

3.6.2.1.7 Other Salmon

When the Regional Administrator determines that 42,000 non-Chinook salmon have been caught by vessels using trawl gear during the time period of August 15 through October 14 in the catcher vessel operational area (see Section 3.5.2.1.6), NMFS will prohibit fishing with trawl gear for the remainder of the period September 1 through October 14 in the chum salmon savings area (see Section 3.6.2.2.3). Accounting for the 42,000 fish PSC limit will begin on August 15.

3.6.2.2 PSC Limitation Zones

Restrictions within the following areas are triggered by the attainment of bycatch limits as described in the FMP (Section 3.6.2.1) or specified in regulations implementing the FMP. Annual area closures that may also serve to limit the bycatch of prohibited species are listed in Section 3.5.2.

3.6.2.2.1 Zones 1 and 2

Zones 1 and 2 close to directed fishing when crab bycatch limits, as specified in regulations, are attained in specific fisheries. The areas are described in Appendix B and Figure 3-8.

3.6.2.2.2 *C. Opilio* Bycatch Limitation Zone

Upon attainment of the *C. Opilio* Bycatch Limitation Zone (COBLZ) bycatch allowance of *C. opilio* crab specified for a particular fishery category, the COBLZ will be closed to directed fishing for each category for the remainder of the year or for the remainder of the season. The area is described in Appendix B and Figure 3-9.

3.6.2.2.3 Herring Savings Areas

If the Regional Administrator determines that the PSC limit of herring is attained, the herring savings areas may be closed for the remainder of the year or season. The herring savings areas are any of the three areas described in Appendix B and Figure 3-10. Summer Herring Savings Area 1 applies from June 15 through July 1 of a fishing year. Summer Herring Savings Area 2 applies July 1 through August 15 of a fishing year.

Winter Herring Savings Area applies from September 1 through March 1 of the succeeding fishing year. Openings and closures begin and end at noon local time.

3.6.2.2.4 Chum Salmon Savings Area

Upon attainment of the limit described in Section 3.6.2.1.7, NMFS will prohibit fishing with trawl gear for the remainder of the period September 1 through October 14 in the chum salmon savings area (described in Appendix B and Figure 3-4). This area is also closed to all trawling from August 1 through August 31, as described in Section 3.5.2.1.3.

3.6.2.2.5 Chinook Salmon Savings Areas

If the Regional Administrator determines that the Bering Sea subarea PSC limit of Chinook salmon is caught while harvesting pollock with trawl gear in the Bering Sea subarea between January 1 and December 31, NMFS will prohibit directed fishing for pollock with trawl gear in Chinook salmon savings areas 1 and 2 (described in Appendix B and Figure 3-11), during time periods specified in regulations.

If the Regional Administrator determines that the Aleutian Islands subarea PSC limit of Chinook salmon is caught while harvesting pollock with trawl gear in the Aleutian Islands subarea between January 1 and December 31, NMFS will prohibit directed fishing for pollock with trawl gear in Chinook salmon savings area 1 (described in Appendix B and Figure 3-11), during time periods specified in regulations.

Figure 3-8 Crab PSC Limitation Zones 1 and 2.

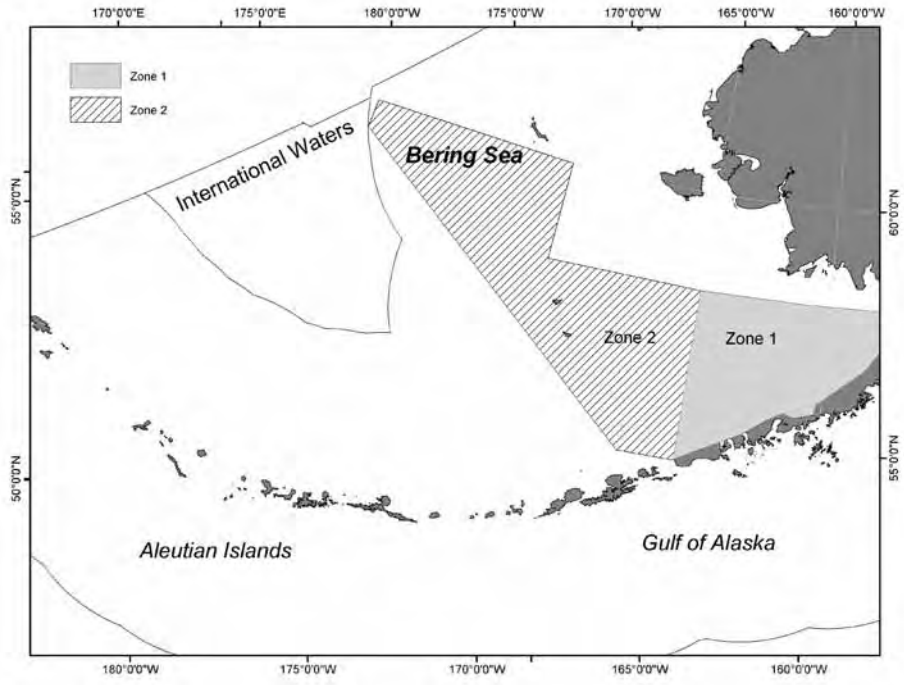


Figure 3-9 *Chinoecetes opilio* Bycatch Limitation Zone.

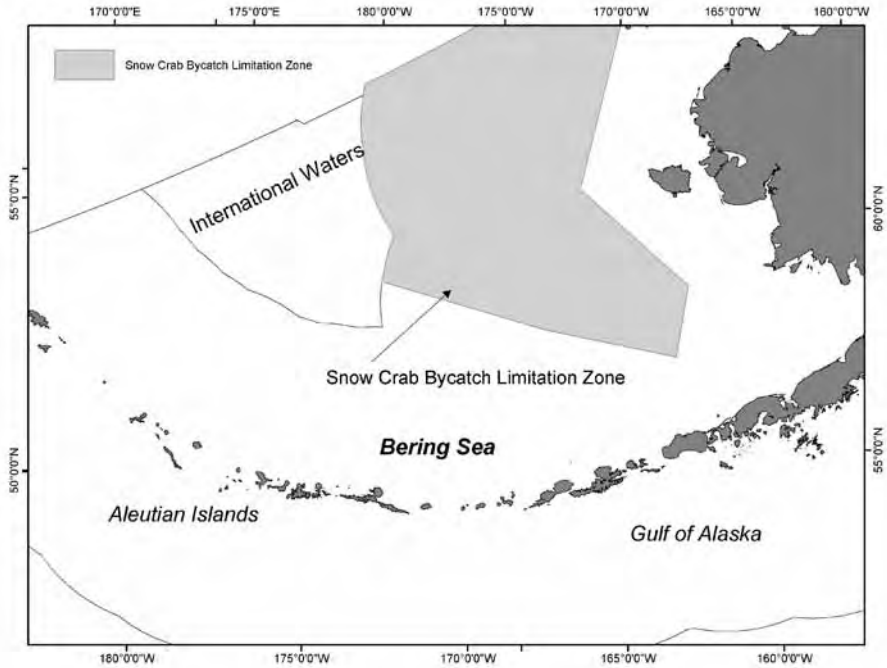


Figure 3-10 Herring Savings Areas.

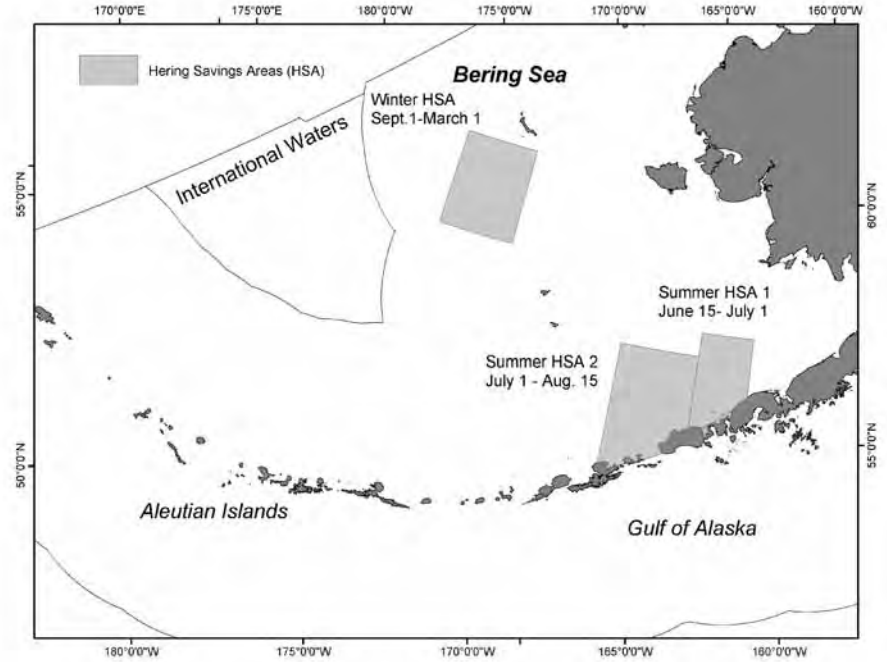
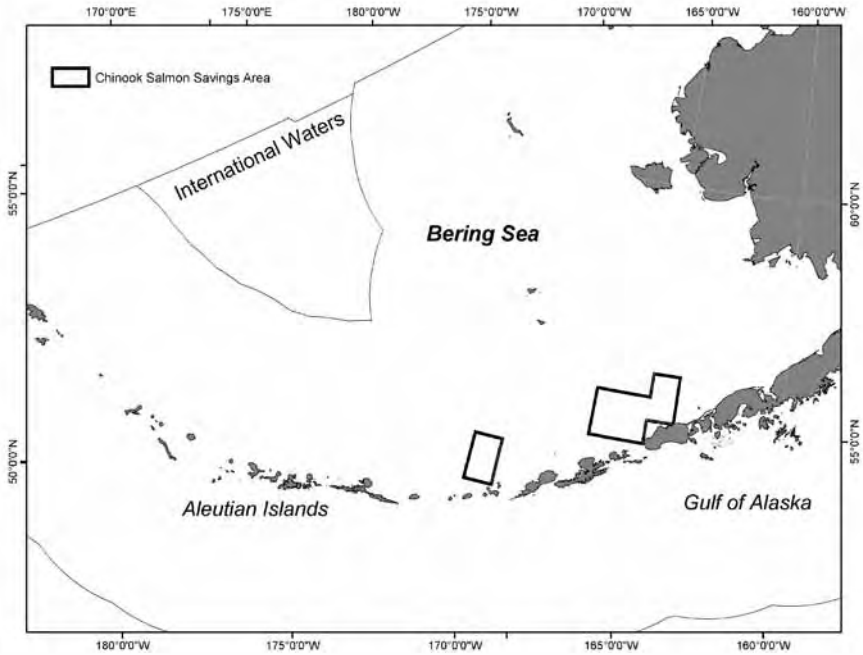


Figure 3-11 Chinook Salmon Savings Areas.



3.6.2.3 Apportionment of Prohibited Species Catch Limits

3.6.2.3.1 Target Fishery Categories

Trawl fisheries: The Pacific halibut PSC limit for trawl gear and the PSC limits for *C. bairdi* crab, *C. opilio* crab, red king crab, and herring apply to trawl fisheries for groundfish that are categorized by target species or species groups.

Non-trawl fisheries: The Pacific halibut PSC limit for non-trawl gear applies to non-trawl groundfish fisheries that may be categorized by target species or species groups, gear type, and area.

Fishery categories will be implemented by regulations that implement the goals and objectives of the FMP, the Magnuson-Stevens 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 3.6.2.

3.6.2.3.2 Apportionments and Seasonal Allocations

Apportionments of PSC limits to target fishery categories established in Section 3.6.2.3.1, 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 October Council meeting. The Plan Team will provide the Council 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.

2. October Council meeting. While recommending proposed groundfish harvest levels under Section 3.2.3, the Council will also review the need to control the bycatch of prohibited species and will recommend appropriate apportionments of PSC limits to fishery categories as bycatch allowances. Fishery bycatch allowances are intended to 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 may recommend exempting specified non-trawl fishery categories from the non-trawl halibut bycatch mortality limit restrictions after considering the same factors (1) through (8) set forth under Section 3.6.2.1.4. The Council will also review the need for seasonal apportionments of fishery bycatch allowances.

   The Council will consider the best available information when recommending fishery apportionments of PSC limits and seasonal allocation of those apportionments. 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 October meeting, the Secretary will publish the Council's recommendations as a notice in the *Federal Register*. Information on which the recommendations are based will also 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 3.2.3 which provides the best available information on estimated prohibited species bycatch rates in the target groundfish fisheries, recommendations for halibut PSC limits and apportionments thereof among the target fisheries and gear types, and also may include an economic analysis of effects of the apportionments.

5. December Council meeting. While recommending final groundfish harvest levels, the Council reviews public comments, takes public testimony, and makes final decisions on apportionments of PSC limits among fisheries and seasons, using the factors (a) through (g) set forth under (2) above. The Council also makes final decisions on the exemption of any non-trawl fishery category from halibut bycatch mortality restrictions using the factors (1) through (8) set forth under Section 3.6.2.1.4.

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.

3.6.3 Retention and Utilization Requirements

3.6.3.1 Utilization of Pollock

Roe-stripping of pollock is prohibited, and the Regional Administrator 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.

3.6.3.2 Improved Retention/Improved Utilization Program

Minimum retention requirements

All vessels participating in the groundfish fisheries are required to retain all catch of Improved Retention /Improved Utilization Program (IR/IU) species, pollock and Pacific cod, when directed fishing for those species is open, regardless of gear type employed and target fishery. When directed fishing for an IR/IU species is prohibited, retention of that species is required only up to any maximum retainable amount in effect for that species, and these retention requirements are superseded if retention of an IR/IU species is prohibited by other regulations.

No discarding of whole fish of these species is allowed, either prior to or subsequent to that species being brought on board the vessel. At-sea discarding of any processed product from any IR/IU species is also prohibited, unless required by other regulations.

Minimum utilization requirements

All IR/IU species caught in the BSAI must be either (1) processed at sea subject to minimum product recovery rates and/or other requirements established by regulations implementing the FMP, or (2) delivered in their entirety to onshore processing plants for which similar processing requirements are implemented by State regulations.

3.6.4 Bycatch Reduction Incentive Programs

3.6.4.1 Prohibited Species Catch

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 3.6.2. The intended effect of such measures is to increase the opportunity to harvest groundfish TACs before established PSC limits are reached.

3.7 Share-based Programs

This section describes the share-based programs that are in place for specific target fisheries in the Bering Sea and Aleutian Islands groundfish fisheries.

3.7.1 Fixed Gear Sablefish Fishery

The directed fixed gear sablefish fishery is managed under an Individual Fishing Quota (IFQ) program, implemented in 1994-1995. This form of limited entry replaced the open access fisheries for sablefish in the BSAI management area.

3.7.1.1 Definitions

For purposes of Section 3.7.1, the following definitions of terms apply:

Person means any individual who is a citizen of the United States or any corporation, partnership, association, or other entity (whether or not organized or existing under the laws of any state) that meets the requirements set forth in 46 CFR Part 67.03, as applicable.

An Individual means a natural person who is not a corporation, partnership, association, or other entity.

Quota shares (QS) are equal to a person's fixed gear landings (qualifying pounds) for each area fished.

The Quota Share Pool is the total amount of quota share in each management area. The quota share pool may change over time due to appeals, enforcement, or other management actions.

Individual Fishing Quota (IFQ) means the annual poundage of fish derived by dividing a person's quota share into the quota share pool and multiplying that ratio by the annual fixed gear TAC for each management area.

Fixed Gear is defined to include all hook and line fishing gears (longlines, jigs, handlines, troll gear, and pot gear).

Catcher boat or catcher vessel means any vessel that delivers catch or landing in an unfrozen state.

Freezer longliner means any vessel engaged in fishing in the fixed gear fishery which, during a given trip, utilizes freezer capacity and delivers some or all of its groundfish catch in a frozen state.

Qualified crewmember is defined as any person that has acquired commercial fish harvesting time at sea (i.e. fish harvesting crew) equal to 5 months of any commercial fish harvesting activity in a fishery in state or federally managed waters of the U.S.. Additionally, any individual who receives an initial allocation of quota share will be considered a bona fide crew member.

3.7.1.2 Management Areas

Quota shares and IFQs are made available for the Bering Sea and Aleutian Islands management sub-areas identified in this FMP.

3.7.1.3 Initial Allocation of Quota Shares

3.7.1.3.1 Initial Recipients

1. Initial assignments of quota shares are made to:
    a. a qualified person who is a vessel owner who meets the requirements in this section; or
    b. a qualified person who meets the requirements of this section engaged in a lease of a fishing vessel (written or verbal) or other “bare-boat charter” arrangement in order to participate in the

fishery. (For instances identified under this section, the qualified person shall receive full credit for deliveries made while conducting the fishery under such a lease or arrangement.)

2. Initial quota shares for sablefish are assigned only to persons who meet all other requirements of this section and who have landed those species in any one of the following years: 1988, 1989, or 1990. These three years shall be known as the quota share qualifying years.

3. Quota shares are assigned initially for each management subarea to qualified persons based on recorded landings, as documented through fish tickets or other documentation for fixed gear landings. Historical catch of sablefish is counted from 1985 through 1990. This historical period is known as the quota share base period. For each management subarea, NMFS will select a person's best five (5) years (subject to approval of the person involved) from the quota share base period to calculate their quota shares.

4. The sum of the catch in each person's five (5) selected years for each area shall equal that person's quota shares for that area. All quota share in any area are added together to form the “Quota Share Pool” for that area.

3.7.1.3.2 Vessel Categories

Quota shares and IFQs shall be assigned by vessel category as follows:

1. Freezer Longliner Shares:

   A vessel is determined to be a freezer longliner in any year, if during that year it processed (froze) fixed gear (as defined above) caught groundfish. If a vessel is determined to be a freezer longliner and that vessel was used in the most recent calendar year of participation by the owner through September 25, 1991, then all qualifying pounds landed by that vessel owner during the qualifying years shall be assigned as freezer longliner shares, unless the owner also participated in the most recent year through September 25, 1991, operating only as a catcher vessel, then shares will be assigned to separate categories, in proportion to the catch made aboard each of the vessels.

2. Catcher Boat Shares:

   a. All landings made during the quota share base period by a vessel owner, whose last vessel that participated in a fixed gear fishery through September 25, 1991, is determined to be a catcher vessel, shall be allocated catcher boat quota shares.

   b. There are two categories of catcher boat shares for the sablefish QS/IFQ fishery:

      i. vessels less than or equal to 60 ft in length overall, and

      ii. vessels greater than 60 ft in length overall.

   c. For initial allocation of catcher boat quota shares:

      i. if, during the last year of participation in a fixed gear fishery through September 25, 1991, a quota share recipient simultaneously owned or leased two or more vessels on which sablefish were landed, and those vessels were in different vessel categories, then the quota share allocation is for each vessel category and may not be combined into a single category.

      ii. if a quota share recipient bought or sold vessels in succession during the qualifying period, and to the extent the quota share recipient operations were in one vessel category during one year and the next vessel owned was in another vessel category, the quota share is combined and applied to the latest vessel category of ownership as of September 25, 1991.

3. Community Development Quota (CDQ) Compensation Quota Share:

   All CDQ compensation quota share initially issued to a person in an IFQ regulatory area in which that person does not hold quota share is designated as uncategorized catcher vessel quota share, except if the CDQ compensation quota share initially issued to a person in an IFQ regulatory area in which that person does not hold quota share is issued as compensation for quota share foregone in the freezer vessel category, in which case it is designated as freezer vessel quota share. The IFQ resulting from uncategorized catcher vessel quota share can be fished on a vessel of any length. CDQ compensation quota share will remain uncategorized until it is transferred; upon transfer the CDQ compensation quota share must be designated in a specific catcher vessel category.

3.7.1.3.3 Quota Share Blocks

1. All initial allocations of sablefish quota share and all CDQ compensation quota share initially issued to a person in an IFQ regulatory area that would result in less than 20,000 lbs of IFQ based on the 1994 TAC for the fixed gear sablefish fishery in that area are issued as a quota share block.
2. All initial allocations of sablefish quota share that would result in at least 20,000 lbs of IFQ based on the 1994 TAC for the fixed gear sablefish fishery in that area, and all CDQ compensation quota share initially issued to a persons in an IFQ regulatory area in which that person does not hold quota share, are issued as unblocked quota share.

3.7.1.4 Transfer Provisions

1. Any person owning freezer longliner quota shares may sell or lease those quota shares to any other qualified person for use in the freezer longliner category.
2. Any person owning catcher boat quota shares may sell those quota shares to any person meeting the provisions outlined in this section. Ten percent of a person's catcher boat quota shares may be leased during the first three years following implementation.
3. In order to purchase or lease quota share, the purchaser must be an individual who is a U.S. citizen and a bona fide fixed gear crew member. Additionally, persons who received an initial allocation of catcher boat quota share may purchase catcher boat quota share and/or IFQs.
4. Quota shares, or IFQs arising from those quota shares, for any management area may not be transferred to any other management area or between the catcher boat and the freezer boat categories. Quota shares, or IFQs arising from those quota shares, initially issued to Category B vessels may be used on Category C vessels.
5. The Secretary may, by regulation, designate exceptions to this section to be employed in case of personal injury or extreme personal emergency which allow the transfer of catcher boat QS/IFQs for limited periods of time.
6. Quota share designated as a “block” may only be traded in its entirety and may not be divided into smaller quota share units. Blocks of quota share representing IFQs of less than 5,000 lbs in the initial allocation may be combined or “swept-up”, to form larger blocks, as long as the consolidated block does not result in IFQs greater than 5,000 lbs.

3.7.1.5 Use and Ownership Provisions

1. Fish caught with freezer longliner IFQs may be delivered frozen or unfrozen.

2. Fish caught with catcher boat quota shares may not be frozen aboard the vessel utilizing those quota shares.

3. Sablefish IFQ resulting from quota share assigned to vessel categories B and C may be used on a vessel with processing capacity as long as processed sablefish or halibut is not on the vessel during that same trip. Further, non-IFQ species may be processed on a vessel using sablefish IFQ resulting from quota share assigned to vessel categories B and C.

4. In order to use catcher boat IFQs the user must: 1) own or lease the quota share, 2) be a U.S. citizen, 3) be a bona fide crew member, 4) be aboard the vessel during fishing operations, and 5) sign the fish ticket upon landing except as noted in (5) below, or in emergency situations.

5. Persons, as defined in Section 3.7.1.1, who receive initial catcher vessel quota share may utilize a hired skipper to fish their quota providing the person owns the vessel upon which the quota share will be used, or the vessel is owned by a person with whom the quota share holder is affiliated through membership in a corporation or partnership. These initial recipients may purchase up to the total share allowed for the area. There shall be no leasing of such catcher vessel quota share other than as provided for in Section 3.7.1.4 above.

   This provision will cease upon the sale or transfer of quota share or upon any change in the identity of the corporation, partnership, or estate as defined below:

   a. Corporation: Any corporation that has no change in membership, except a change caused by the death of a corporate member providing the death did not result in any new corporate member. Additionally, corporate membership is not deemed to change if a corporate member becomes legally incapacitated and a trustee is appointed to act on his behalf, nor is corporate membership deemed to have changed if the ownership shares among existing members change, nor is corporate membership deemed to have changed if a member leaves the corporation.

   b. Partnership: Any partnership that has no change in membership, except a change caused by the death of a partner providing the death did not result in any new partners. Additionally, a partnership is not deemed to have changed if a partner becomes legally incapacitated and a trustee is appointed to act on his behalf, nor is a partnership deemed to have changed if the ownership shares among existing partners change, nor is a partnership deemed to have changed if a partner leaves the partnership.

   c. Estate: Any estate that has not been disposed to a legal heir.

   d. Individual: Any individual as defined in Section 3.7.1.1.

6. For sablefish, each qualified person or individual may own, hold, or otherwise control, individually or collectively, but may not exceed, 3,229,721 units of quota share for the GOA and BSAI.

7. Any person who receives an initial assignment of quota shares in excess of the limits set forth in (6) of this section shall:

   a. be prohibited from purchasing, leasing, holding or otherwise controlling additional quota shares until that person's quota share falls below the limits set forth in (6) above, at which time each such person shall be subject to the limitations of paragraph (6) above; and

   b. be prohibited from selling, trading, leasing or otherwise transferring any interest, in whole or in part, of an initial assignment of quota share to any other person in excess of the limitations set forth in (6) above.

8. For sablefish, no more than 1% of the combined GOA and BSAI quota may be taken on any one vessel.

9. Persons must control IFQs for the amount to be caught before a trip begins, with the exception that limited overages will be allowed as specified in an overage program approved by NMFS and the International Pacific Halibut Commission.

10. Quota Share Block Provisions

    a. A person may own and use up to two blocks in each management area.

    b. Persons owning two blocks in a given management area may not use normal quota share in that area.

    c. Persons who own less than two blocks in an area may own and use normal quota share up to the limits specified under this program, noting that the limit applies to both normal quota share and quota share embedded in blocks.

3.7.1.6 Annual Allocation of Quota Share/Individual Fishing Quota

Individual fishing quotas are determined for each calendar year for each person by applying the ratio of a person's quota share to the quota share pool for an area to the annual fixed gear total allowable catch for each management area, after adjusting for the CDQ program. In mathematical terms, IFQs = (QS / QS pool) x fixed gear TAC.

3.7.1.7 General Provisions

1. For IFQ accounting purposes:

    a. The sale of catcher vessel caught sablefish or halibut to other than a legally registered buyer is illegal, except that direct sale to dockside customers is allowed provided the fisher is a registered buyer and proper documentation of such sales is provided to NMFS.

    b. Frozen product may only be off-loaded at sites designated by NMFS for monitoring purposes;

    c. Persons holding IFQs and wishing to fish must check-in with NMFS or their agents prior to entering any relevant management area, additionally any person transporting IFQ caught fish between relevant management areas must first contact NMFS or their agents.

2. Quota shares and IFQs arising from those quota shares may not be applied to trawl-caught sablefish.

3. Quota shares are a harvest privilege, and good indefinitely. However, they constitute a use privilege which may be modified or revoked by the Council and the Secretary at any time without compensation.

4. Discarding of sablefish is prohibited by persons holding sablefish IFQs and those fishing under the CDQ program.

5. Any person retaining sablefish or halibut with commercial fixed gear must own or otherwise control IFQs.

6. Persons holding IFQs may utilize those privileges at any time during designated seasons. Retention of fixed-gear caught sablefish or any halibut is prohibited during closed seasons. Seasons will be identified by the Council and the International Pacific Halibut Commission on an annual basis.

7. Those persons that would otherwise have received a full complement of sablefish quota share in the BSAI management area, but would receive less due to the provisions of CDQs, will be partially compensated and the cost of the compensation will be borne equally by all initial sablefish QS/IFQ

recipients. In general this compensation plan will issue incremental amounts of quota share in each non-CDQ area to each disadvantaged person.

3.7.2 American Fisheries Act Pollock Fishery

Subtitle II of the American Fisheries Act (AFA) of 1998, entitled *Bering Sea Pollock Fishery*, directed the Council and NMFS to develop and implement four general categories of management measures: 1) regulations that limit access into the fishing and processing sectors of the BSAI pollock fishery and that allocate pollock to such sectors, 2) regulations governing the formation and operation of fishery cooperatives, 3) regulations that institute sideboard measures to protect other fisheries from spillover effects from the AFA, and 4) regulations governing catch measurement and monitoring in the BSAI pollock fishery. Key provisions are summarized in Appendix C. This entire subtitle of the AFA is incorporated into the FMP by reference and all management measures that are consistent with the provisions of Subtitle II of the AFA will be issued through regulations. The subtitle is reprinted in Appendix C.

3.7.2.1 Management Measures to Supersede the American Fisheries Act

Subsection 213(c) of the AFA (Appendix C) provides the Council with the authority to recommend management measures to supersede certain provisions of the AFA.

Any measure recommended by the Council that supersedes a specific provision of the AFA must be implemented by FMP amendment in accordance with the Magnuson-Stevens Act. Under the authority set out in subsection 213(c) of the AFA, the Council has recommended the following management measures to supersede specific provisions of sections 210 and 211 of the AFA. These measures shall be implemented by NMFS through regulation.

3.7.2.1.1 Inshore Cooperative Allocation Formula

(supersedes the inshore cooperative allocation formula set out in subparagraph 210(b)(1)(B) of the AFA)

An inshore catcher vessel cooperative that applies for and receives an AFA inshore cooperative fishing permit will receive a sub-allocation of the annual Bering Sea subarea inshore sector directed fishing allowance. If the Aleutian Islands subarea is open to directed fishing for pollock then the cooperative also will receive a sub-allocation of the annual Aleutian Islands subarea inshore sector directed fishing allowance.

Each inshore cooperative's annual allocation amount(s) is determined using the following procedure:

1. Calculation of individual vessel catch histories. The Regional Administrator will calculate an official AFA inshore cooperative catch history for every inshore-sector endorsed AFA catcher vessel according to the following steps:

    a. Determination of annual landings. For each year from 1995 through 1997 the Regional Administrator will determine each vessel's total inshore landings; from the Bering Sea subarea and Aleutian Islands subarea separately.

    b. Offshore compensation. If a catcher vessel made a total of 500 or more mt of landings of Bering Sea subarea pollock or Aleutian Islands subarea pollock to catcher/processors or offshore motherships other than the EXCELLENCE (USCG documentation number 967502); GOLDEN ALASKA (USCG documentation number 651041); or OCEAN PHOENIX (USCG documentation number 296779) over the 3-year period from 1995 through 1997, then all

offshore pollock landings made by that vessel during from 1995 through 1997 will be added to the vessel's inshore catch history by year and subarea.

c. Best two out of three years. After steps (a) and (b) are completed, the 2 years with the highest landings will be selected for each subarea and added together to generate the vessel's official AFA inshore cooperative catch history for each subarea. A vessel's best 2 years may be different for the Bering Sea subarea and the Aleutian Islands subarea.

2. Calculation of annual quota share percentage. Each inshore pollock cooperative that applies for and receives an AFA inshore pollock cooperative fishing permit will receive an annual quota share percentage of pollock for each subarea of the BSAI that is equal to the sum of each member vessel's official AFA inshore cooperative catch history for that subarea divided by the sum of the official AFA inshore cooperative catch histories of all inshore sector-endorsed AFA catcher vessels. The cooperative's quota share percentage will be listed on the cooperative's AFA pollock cooperative permit.

3. Conversion of quota share to annual TAC allocation. Each inshore pollock cooperative that receives a quota share percentage for a fishing year will receive an annual allocation of Bering Sea and/or Aleutian Islands pollock that is equal to the cooperative's quota share percentage for that subarea multiplied by the annual inshore pollock allocation for that subarea. Each cooperative's annual pollock TAC allocation may be published in the interim, and final BSAI TAC specifications notices.

3.7.2.1.2 Definition of Qualified Catcher Vessel

(supersedes AFA paragraph 210(b)(3) that has the effect of requiring a qualified catcher vessel to have actually fished for BSAI pollock in the year prior to the year in which the cooperative will be in effect)

A catcher vessel is qualified to join an inshore catcher vessel cooperative under paragraph 210(b)(3) of the AFA, if:

1. Active vessels. The vessel delivered more pollock harvested in the BSAI inshore directed pollock fishery to the inshore cooperative’s designated AFA inshore processor than to any other shoreside processor or stationary floating processor during the year prior to the year in which the cooperative fishing permit will be in effect; or

2. Inactive vessels. The vessel delivered more pollock harvested in the BSAI inshore directed pollock fishery to the inshore cooperative’s designated AFA inshore processor than to any other shoreside processor or stationary floating processor during the last year in which the vessel harvested BSAI pollock in the directed fishery for delivery to an AFA inshore processor.

3.7.2.1.3 Crab Processing Sideboard Limits

(supersedes the 1995-1997 formula set out in subparagraph 211(c)(2)(A) of the AFA)

Upon receipt of an application for a cooperative processing endorsement from the owners of an AFA mothership or AFA inshore processor, the Regional Administrator will calculate a crab processing cap percentage for the associated AFA inshore or mothership entity. The crab processing cap percentage for each BSAI king or Tanner crab species is equal to the percentage of the total catch of each BSAI king or Tanner crab species that the AFA crab facilities associated with the AFA inshore or mothership entity processed in the aggregate, on average, in 1995, 1996, 1997, and 1998 with 1998 given double-weight (counted twice).

3.7.2.1.4 Inshore Cooperative Contract Fishing by non-Member Vessels

(supercedes subparagraph 210(b)(1)(B) of the AFA that prohibits inshore cooperative vessels from fishing in excess of their cooperative allocation, and paragraph 210(b)(5) of the AFA that prohibits inshore cooperative vessels from fishing for any BSAI pollock that is not allocated to the cooperative under 210(b)(1)(B))

An inshore catcher vessel cooperative may contract with a non-member vessel to harvest a portion of its inshore pollock allocation provided that the non-member vessel holds an AFA catcher/vessel permit with an inshore processing endorsement and is a member of another inshore cooperative. Procedures for entering into and fishing under such contracts will be established in regulations.

3.7.3 Aleutian Islands Directed Pollock Fishery

Section 803 of the Consolidated Appropriations Act of 2004 (Pub. L. 108-199) established the Aleutian Islands directed pollock fishery allocation to the Aleut Corporation. This act supersedes the AFA provisions for the directed pollock fishery in the Aleutian Islands subarea. Beginning in 2004, the directed pollock fishery in the Aleutian Islands is fully allocated to the Aleut Corporation for the purpose of economic development in Adak, Alaska. NMFS, in consultation with the Council, will manage the Aleutian Islands directed pollock fishery to ensure compliance with the implementing statute (Pub. L. 108-199) and with the annual harvest specifications. Management provisions and considerations may include but are not limited to: prohibitions on having pollock from more than one management area on board the vessel, catch monitoring control plan requirements for shoreside and stationary floating processors, Aleut Corporation responsibilities for vessel and processor approval and quota management, observer requirements, and economic development reporting.

The harvest specifications for the Aleutian Islands directed pollock fishery includes the following provisions:

1. During the harvest specifications process, the Aleutian Islands directed pollock fishery will be funded from the difference between the sum of all BSAI groundfish fishery TACs and the BSAI 2 million mt OY cap, unless the difference is not large enough to do so. If the difference between the sum of all BSAI groundfish fishery TACs and the OY cap is not large enough, balance of the pollock allocation to the Aleutian Islands fishery will be funded by a reduction in the Bering Sea pollock initial TAC.
2. The allocation of pollock for harvest in the Aleutian Islands will be established from the BSAI pollock initial TAC, (the BSAI TAC after subtraction of the CDQ reserve). The annual Aleutian Islands pollock initial TAC will equal th e limit on the Aleutian Islands pollock initial TAC specified in regulations when the Aleutian Islands pollock ABC is equal to or more than the limit on the Aleutian Islands pollock initial TAC specified in regulations. When the Aleutian Islands pollock ABC is less than the limit on the Aleutian Islands pollock initial TAC specified in regulations, the annual Aleutian Islands pollock ITAC will not exceed the annual Aleutian Islands pollock ABC.
3. The incidental catch allowance for pollock in the Aleutian Islands will be deducted from the Aleutian Islands annual pollock initial TAC.
4. The A season apportionment of the directed pollock fishery allocation will be the lesser of:
    a. No more than 40 % of the AI pollock ABC, or
    b. The annual AI pollock initial TAC, after subtraction of the incidental catch allowance.

The total harvest of pollock in the A season (directed pollock fishery and incidental catch allowance) will not exceed 40 % of the annual Aleutian Islands pollock ABC.

The directed pollock fishery allocation to the B season will be equal to the annual Aleutian Islands pollock initial TAC minus the incidental catch allowance and minus the A season directed pollock fishery allocation. The B season allocation may be further adjusted by rollover of unharvested A season pollock.

5. Any unharvested pollock initial TAC from the Aleutian Islands fishery that is not expected to be harvested during the fishing year will be rolled back to the Bering Sea subarea pollock fishery in accordance with regulations. This roll back will occur at the earliest time possible in the calendar year in accordance with regulations.

6. The harvest of the Aleutian Islands directed pollock fishery allocation is limited to vessels eligible to harvest pollock under section 208 of Title II, Division C of Pub. L. 105-277 and vessels 60 feet or less in length over all. During 2005 through 2008, no more than 25 percent of the directed pollock fishery may be allocated to vessels 60 feet or less in length overall. During 2009 through 20012, no more than 50 percent of the directed pollock fishery may be allocated to vessels 60 feet or less in length overall. Beginning in 2013, 50 percent of the directed pollock fishery will be allocated to vessels 60 feet or less in length overall.

3.7.4 Community Development Quota Multispecies Fishery

The western Alaska Community Development Quota (CDQ) Program (hereinafter the CDQ Program) was established to provide fishermen who reside in western Alaska communities a fair and reasonable opportunity to participate in the Bering Sea and Aleutian Islands groundfish fisheries; to expand their participation in salmon, herring, and other nearshore fisheries; and to help alleviate the growing social economic crisis within these communities. Residents of western Alaska communities are predominantly Alaska Natives who have traditionally depended upon the marine resources of the Bering Sea for their economic and cultural well-being. The CDQ program is a joint program of the Secretary and the Governor of the State of Alaska.

The purpose of the CDQ program is to allocate CDQ to CDQ groups representing eligible Western Alaska communities. The first priority for use of these allocations is to provide the means for investing in, participating in, starting, or supporting commercial fisheries business activities that will result in an ongoing, regionally-based fisheries economy. The second priority is to strengthen the non-fisheries related economy in the CDQ region.

The NMFS Regional Administrator shall hold the designated percent of the annual total allowable catch of groundfish for each managements subarea in the Bering Sea and Aleutian Islands for the western Alaska community quota as noted below. These amounts shall be released to eligible Alaska communities who submit a plan, approved by the Governor of Alaska, for their wise and appropriate use.

The CDQ program is structured such that the Governor of Alaska is authorized to recommend to the Secretary that a Bering Sea rim community be designated as an eligible fishing community to receive a portion of the reserve. To be eligible a community must meet specified criteria and have developed a fisheries development plan approved by the Governor of Alaska. The Governor shall develop such recommendations in consultation with the Council. The Governor shall forward any such recommendations to the Secretary, following consultation with the Council. Upon receipt of such recommendations, the Secretary may designate a community as an eligible fishing community and, under the plan, may release appropriate portions of the reserve.

Not more than 33 percent of the total western Alaska community quota may be designated for a single CDQ applicant, except that if portions of the total quota are not designated by the end of the second quarter, applicants may apply for any portion of the remaining quota for the remainder of that year only.

3.7.4.1 Eligible Western Alaska Communities

The Governor of Alaska is authorized to recommend to the Secretary that a community within western Alaska which meets all of the following criteria be eligible for the CDQ program:

1. be located on or proximate to the Bering Sea coast from the Bering Strait to the western most of the Aleutian Islands or a community located on an island within the Bering Sea, which the Secretary of the Interior has certified pursuant to section 11(b)(2) or (3) of Pub. L. No. 92-203 as Native villages are defined in section 3(c) of Pub. L. No. 92-203;
2. be unlikely to be able to attract and develop economic activity other than commercial fishing that would provide a substantial source of employment;
3. its residents have traditionally engaged in and depended upon fishing in the waters of the Bering Sea coast;
4. has not previously developed harvesting or processing capability sufficient to support substantial participation in the commercial groundfish fisheries of the BSAI because of a lack of sufficient funds for investing in harvesting or processing equipment; and
5. has developed a community development plan approved by the Governor, after consultation with the Council.

Also, Akutan is included in the list of eligible CDQ communities.

3.7.4.2 Fixed Gear Sablefish Allocation

The NMFS Regional Administrator shall hold 20 percent of the annual fixed-gear total allowable catch of sablefish for each management subarea in the BSAI for the western Alaska sablefish community quota. The portions of sablefish TACs for each management area not designated to CDQ fisheries will be allocated as quota share and IFQs and shall be used pursuant to the program outlined in Section 3.7.1.

3.7.4.3 Pollock Allocation

Ten percent of the pollock TAC in the BSAI management area shall be allocated as a directed fishing allowance to the CDQ program. This quota shall be released to communities on the Bering Sea coast which submit a plan, approved by the Governor of Alaska, for the wise and appropriate use of the quota.

3.7.4.4 Multispecies Groundfish and Prohibited Species Allocations

In addition to the CDQ allocations authorized in Section 3.7.3.2 and Section 3.7.3.3, 7.5 percent of the TAC for all BSAI groundfish species or species groups, except squid, will be issued. A pro-rata share of PSC species will also be issued. PSC will be allocated before the trawl/non-trawl splits. The program is patterned after the pollock CDQ program.

3.8 Flexible Management Authority

3.8.1 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 Administrator and/or the Council during the course of a fishing year which warrants inseason adjustments to 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. 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 Administrator to protect the resource from biological harm by instituting gear modifications or adjustments through closures or restrictions. Other changes warrant action to provide greater fishing opportunities for the industry by instituting time/area adjustments through openings or extension of a season beyond a scheduled closure.

Other inseason actions may be necessary to promulgate interim fishery closures in portions of the Bering Sea and the Aleutian Islands management subareas to reduce prohibited species bycatch rates and the probability of premature attainment of PSC limits and allowances. The intent of such interim closures would be to provide fishermen with a greater opportunity to harvest groundfish quota amounts by guaranteeing a longer fishing period before PSC limits or allowances are reached and bycatch zones or areas are closed to specified fisheries or gear types.

Ideally, the need to implement interim closures of areas to limit fishery operations that exhibit unexpectedly high bycatch rates would be identified through an examination of bycatch data collected inseason by observers. At times, however, data on bycatch rates may not be timely enough for effective implementation of season closures. Alternatively, the fishery bycatch rates may vary so much from week to week that the Regional Administrator may have difficultly determining whether bycatch rates in a fishery or area are intrinsically high, are an exhibition of “dirty fishing”, or simply reflect natural variability in an otherwise “clean” fishery or area. Historical data could be used, therefore, to determine whether consistent “hot spots” occur. Historical information may then be compared with variable inseason data to help determine whether an inseason closure is warranted to reduce overall bycatch rates.

The need for inseason action for conservation purposes may be related to several circumstances. For instance, certain target or bycatch species may have decreased in abundance. When new 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. Conservation measures limited to establishing prohibited species catch 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 demonstrates 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 is more abundant than was anticipated when 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 that 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 or her delegation to the Regional Administrator of NMFS, to make inseason adjustments to conserve fishery resources on the basis of all relevant information. Using all available information, he or she may extend, open, or close fisheries in all or part of a regulatory area, or restrict the use of any type of fishing gear as a means of conserving the resource. He or she 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; and/or

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 that, on the basis of currently available information, is found by the Secretary to be incorrectly specified.

The Regional Administrator may also promulgate an inseason closure of an area to reduce prohibited species bycatch rates provided the closure period extends no longer than the time period specified in regulations. Interim closures must be based upon a determination that such closures are necessary to prevent:

a. a continuation of relatively high bycatch rates in a statistical areas, or portion thereof;

b. the take of an excessive share of PSC limits or allowances established under Section 3.6.2 by vessels fishing in an area;

c. the closure of one or more directed groundfish fisheries due to excessive prohibited species bycatch rates occurring in a specified target fishery; and

d. the premature attainment of established PSC limits or allowances and associated loss of opportunity to vessels to harvest the groundfish optimum yield.

The types of information that the Regional Administrator will consider in determining whether conditions exist that require an inseason adjustment or action are described as follows, although he or she is not precluded from using information not described but determined to be relevant to the issue:

a. the effect of overall fishing effort within an area;

b. catch per unit of effort and rate of harvest;

c. relative distribution and abundance of stocks of target groundfish species and prohibited species within an area;

d. the condition of a stock in all or part of an area;

e. inseason prohibited species bycatch rates observed in target groundfish fisheries in all or part of a statistical area;

f. historical prohibited species bycatch rates observed in target groundfish fisheries in all or part of a statistical area;

g. economic impacts of fishing businesses being affected; or

h. any other factor relevant to the conservation and management of groundfish species or any incidentally-caught species that are designated as a prohibited species or for which a PSC limit has been specified.

The Regional Administrator is constrained, however, in his or her 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 Administrator 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 that would still allow fisheries to continue for other species; 2) a time/area closure that 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 that 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 or she 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 Administrator 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 Administrator 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-Stevens Act. Any adjustments will be made by the Regional Administrator 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-Stevens Act.

3.8.2 Measures to Address Identified Habitat Problems

An FMP may contain only those conservation and management measures that 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:

a. regulations establishing gear, timing, or area restrictions for purposes of protecting particular habitats of species in the BSAI groundfish fishery;

b. regulations establishing area or timing restrictions to prevent the harvest of fish in contaminated areas; and/or

c. regulations restricting disposal of fishing gear by vessels.

3.8.3 Vessel Safety

The Council will consider, and may provide for, temporary adjustments regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of the vessels, after consultation with the Coast Guard and persons utilizing the fishery.

3.9 Monitoring and Reporting

3.9.1 Recordkeeping and Reporting

The Council and NMFS 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.

The need for the Council and NMFS 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-Stevens Act, Executive Order 12866, 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 NMFS 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-Stevens Act, and other applicable law.

<u>Information on catch and production, effort, and price</u>

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 is required of operators of catcher vessels, catcher/processor vessels, mothership processor vessels, and by responsible officers of shoreside processor plants.

3.9.1.1 Processor Reports

All processors of groundfish shall report information necessary for the management of groundfish resources. The regulations implementing this plan specify the information to be reported and the time schedule for reporting.

3.9.1.2 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 Regional Administrator of 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 TAC is established within a time period prescribed by regulation. This report may be by radio through the U.S. Coast Guard to the Regional Administrator of NMFS. The Council intends that this requirement will enhance the ability of NMFS 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 Administrator within one week of the end of the reporting period through such means as the Regional Administrator 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 BSAI 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; and

h. the product weight, rounded to the nearest 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 or she must record the following information, within a time specified by regulations, for each transfer or off-loading of any fishery product in the EEZ, as well as quantities transferred or off-loaded outside the EEZ, within any state's territorial waters, or within the internal waters of any state:

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 the vessel off-loading to or, if to a shoreside facility, the name of the commercial facility receiving the product; and

d. the intended port of destination of the receiving vessel if off-loaded to another vessel.

3.9.2 Observer Program

The Council and NMFS must have the best available biological and socioeconomic information with which to carry out their responsibilities for conserving and managing groundfish resources. To address management and scientific information needs, NMFS, in consultation with the Council, will require U.S. fishing vessels that catch groundfish from the EEZ or receive groundfish from the EEZ, and shoreside processors that receive groundfish caught in the EEZ, to accommodate observers certified by NMFS. Provisions of the North Pacific Groundfish Observer Program will be developed in consultation with the Council and established in regulations. The purpose of the groundfish observer program is to verify catch composition and quantity, including those discarded at sea, and collect biological information on marine resources.

3.10 Council Review of the Fishery Management Plan

3.10.1 Schedule and Procedures for Evaluation

The Council will maintain a continuing review of the fisheries managed under this FMP through the following methods:

l. Maintain close liaison with the management agencies involved, usually the Alaska Department of Fish and Game and NMFS, 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. Consider all information gained from the above activities and develop, if necessary, 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.

3.10.2 Review of Management Approach

Adaptive management requires regular and periodic review. Objectives identified in the management policy statement (Section 2.2) will be reviewed annually by the Council. The Council will also review, modify, eliminate, or consider new issues, as appropriate, to best carry out the goals and objectives of the management policy.

3.10.3 Review of Essential Fish Habitat Components

To incorporate the regulatory guidelines requirement for review and revision of essential fish habitat (EFH) FMP components, the Council will conduct a complete review of all the EFH components of each FMP once every 5 years and will amend those EFH components to include new information.

In between each five-year comprehensive review, the Council will utilize its annual FMP amendment cycle to solicit proposals on habitat areas of particular concern and/or conservation and enhancement measures to minimize the potential adverse effects from fishing. Those proposals that the Council endorses should be developed independent of the five-year comprehensive EFH review cycle.

An annual review of existing and new EFH information will be conducted and this information will be provided to the BSAI Groundfish Plan Team for their review during the annual SAFE report process. This information could be included in the “Ecosystems Considerations” chapter of the SAFE report.

3.10.4 Prohibited Species Catch Limits and Time/Area Closures for Groundfish Fisheries

The PSC limits and area closures for groundfish 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.

Chapter 4 Description of Stocks and Fishery

A description of the stocks that are managed as part of the Fishery Management Plan (FMP) for the Bering Sea/Aleutian Islands (BSAI) groundfish is contained in Section 4.1, and includes a discussion of stock units and the status and trends of groundfish species. Section 4.2 describes the habitat of the BSAI management area, defines essential fish habitat (EFH) for each of the managed species and provides recommendations, and describes habitat areas of particular concern. Fishing activities that affect the groundfish stocks are addressed in Section 4.3, including the history of exploitation in the BSAI, and a description of the commercial and subsistence fisheries for groundfish. Section 4.4 examines the economic and socioeconomic characteristics of the groundfish fisheries, and Section 4.5 describes fishing communities.

4.1 Stocks

The Bering Sea supports about 300 species of fishes, the majority of which are found near or on the bottom (Wilimovsky 1974). The fish groups of primary concern in this plan are the bottom or near-bottom dwelling forms – the flatfish, rockfish, sablefish, Pacific cod, pollock, and Atka mackerel. Although not bottom-dwelling, squids (*Cephalopoda*), sharks, and octopus are also included in the FMP.

There is a general simplification in the diversity of groundfish species in the Bering Sea compared to the more southern regions of the Gulf of Alaska (GOA) and Washington to California. As a result, certain species inhabiting the Bering Sea are some of the largest groundfish resources found anywhere in the world. Relatively few groundfish species in the eastern Bering Sea and the Aleutian Islands are large enough to attract target fisheries: walleye pollock, Pacific cod, Pacific ocean perch, sablefish, Atka mackerel, several species of rockfish and flatfish. Since the 1960s, pollock catches have accounted for the majority of the Bering Sea groundfish harvest. Yellowfin sole and rock sole currently dominate the flatfish group and have the longest history of intense exploitation by foreign fisheries. Other flatfish species that are known to occur in aggregations large enough to form target species are Greenland turbot, flathead sole, Alaska plaice, and arrowtooth flounder.

4.1.1 Stock Units

The groundfish and squid resources considered in this FMP consist of species that are wide ranging in their general distribution, occurring in the eastern Bering Sea, Aleutian Islands waters, the Gulf of Alaska, and in some cases further south. For the most part, groundfish species are managed as a single stock in the BSAI management area. This section contains a summary of distribution and known stock structure information for the target species. Further information on species stock structure can be found in the annual *Stock Assessment and Fishery Evaluation* (SAFE) report; the information in this section is summarized from the 2003 SAFE report (NPFMC 2003).

For pollock, there are currently three stocks identified for management purposes, although there is undoubtedly some degree of exchange between them. The eastern Bering Sea stock is the largest. There is also an Aleutian Island region stock, and a central Bering Sea-Bogoslof Island pollock stock, which is a mixture of pollock that migrate from the U.S. and Russian shelves to the Aleutian Basin.

Pacific cod is distributed widely over the eastern Bering Sea and the Aleutian Islands area, and in the BSAI is managed as a single unit. Tagging studies (e.g., Shimada and Kimura 1994) have demonstrated significant migration both within and between the eastern Bering Sea, Aleutian Islands, and Gulf of Alaska, and genetic studies (e.g., Grant et al. 1987) have failed to show significant evidence of stock structure within these areas.

Adult sablefish live mainly in offshore waters at bottom depths of 200 meters and greater, from northern Mexico to the Bering Sea (Wolotira et al. 1993). Sablefish appear to form two populations, the northern of which inhabits Alaska and northern British Columbia waters. Northern sablefish appear to be highly migratory, with substantial movement between the BSAI and the GOA (Heifitz and Fujioka 1991, Kimura et al. 1998). As a result, sablefish in Alaska waters are assessed as a single population, although for management purposes discrete regions are identified to distribute exploitation throughout their wide geographical range. In the BSAI, the management areas distinguish the eastern Bering Sea and the Aleutian Islands region.

Flatfish in the BSAI are predominately found on the eastern Bering Sea continental shelf and slope, with lower abundance in the Aleutian Islands for those species whose range extends to that area. Each of the flatfish species is assessed as a single unit in the BSAI.

Yellowfin sole is one of the most abundant flatfish species in the eastern Bering Sea. They inhabit the continental shelf, and abundance in the Aleutian Islands region is negligible. Greenland turbot are distributed throughout the BSAI management area. The absence of juveniles in the Aleutian Islands region suggests that the population originates from the eastern Bering Sea or elsewhere, and the annual stock assessment assumes that Greenland turbot in the two regions represent a single stock. Arrowtooth flounder is most abundant in the eastern Bering Sea but which ranges into the Aleutian Islands region.

Although two species of rock sole are known to occur in the North Pacific ocean, the northern rock sole perdominates in the BSAI. Flathead sole consist of two species of *Hippoglossoides* whose ranges overlap in the BSAI (Walters and Wildebuer 1997). Alaska plaice is mainly distributed on the eastern Bering Sea continental shelf, with a summer distribution at depths less than 110 m.

Rockfish are primarily assessed at the BSAI level, although some species are assigned separate harvest quotas in the eastern Bering Sea and the Aleutian Islands region. Many rockfish are not thought to exhibit large-scale movements as adults. Analysis of genetic material from north Pacific rockfish, with a view to determining evidence of stock structure, is an active area of research.

Pacific ocean perch (POP) inhabit the outer continental shelf and upper slope regions of the north Pacific Ocean and Bering Sea. An earlier study of POP in Alaska analyzed differences in biological features (e.g., growth rate) between eastern Bering Sea and Aleutian Islands fish and suggested that each of these areas has its own unique stock (Chikuni 1975). Further research has posed uncertainty as to whether the eastern Bering Sea POP represent a discrete stock (Spencer and Ianelli 2001), and since 2001, POP in the BSAI have been assessed and managed as a single stock.

Northern rockfish are patchily distributed in the BSAI, with the majority of harvest occurring as incidental catch in the Aleutian Islands Atka mackerel fishery. Initial genetic analysis has revealed no evidence of population structure (Gharrett 2003), although sample sizes were small. Shortraker rockfish in the BSAI appear to be a separate stock from those in the GOA. Rougheye rockfish also show evidence of two distinct speices, with overlapping ranges in the GOA. The two most abundant species in the ‘other rockfish’ complex are the light dusky rockfish and the shortspine thornyhead, however distributions for these species are not well documented.

Atka mackerel center of abundance is the Aleutian Islands region, with a geographical range extending to the waters off Kamchatka, the eastern Bering Sea, and the Gulf of Alaska. Tag capture information from Alaska suggests that Atka mackerel populations are localized and do not travel long distances. Atka mackerel are not targeted in the eastern Bering Sea.

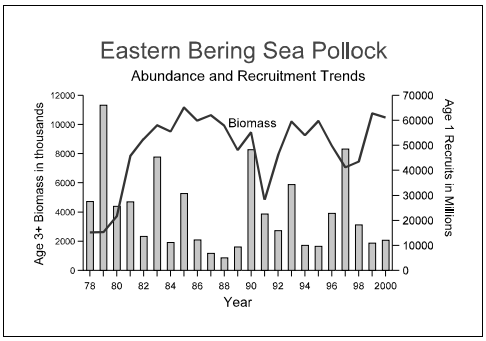
The predominant species of squid in commercial catches in the eastern Bering Sea is believed to be the red squid, *Berryteuthis magister*, while *Onychoteuthis borealijaponicus*, the boreal clubhook squid, is likely the principal species encountered in the Aleutian Islands region. Squid are generally migratory pelagic schooling species, with a lifespan thought to be 1-2 years.

4.1.2 Status of Stocks

This section summarizes the status of the various groundfish stocks of commercial importance in the BSAI. More detailed assessments and current estimates of biomass and acceptable biological catches can be found in the *Stock Assessment and Fishery Evaluation* (SAFE) report, that is produced annually (or biennially for some stocks) by the Bering Sea and Aleutian Islands Groundfish Plan Team (available at www.fakr.noaa.gov/npfmc). The information in this section comes from the November 2003 SAFE report (NPFMC 2003). The SAFE report contains further details on fishery statistics, resource assessment surveys, and the analytical techniques applied to the assessment of the various species.

4.1.2.1 Pollock

Three stocks of pollock inhabit the BSAI area: the eastern Bering Sea, Aleutian Islands, and Aleutian Basin stocks. Exploitation and abundance of these stocks are very different.



The eastern Bering Sea pollock stock peaked in 1985, and declined to about 6 million mt by 1991. Since then, the age 3 and older biomass has increased, and has been variable around 12 million mt. For 2004, spawning biomass of eastern Bering Sea pollock (3,525,000 mt) was estimated to be well above the biomass level that produces maximum sustainable yield (2,468,000 mt).

Projected age 3+ biomass and ABC (mt) of eastern Bering Sea walleye pollock.

Year	Biomass	ABC
2002	9,800,000	2,110,000
2003	11,100,000	2,330,000
2004	11,000,000	2,560,000

The Aleutian Islands pollock stock is considerably smaller than the eastern Bering Sea and Aleutian Basin stock. Age 3+ biomass in the Aleutian Island area is estimated at about 330,000 mt in 2004, and an ABC of 27,400 mt. Between 1999 and 2003, the Council recommended that no directed fishing for pollock occur in the AI area given current low abundance and the importance of pollock as prey for Steller sea lions. In 2004 Congress legislated that the Council would apportion the Aleutian Island pollock TAC to the Aleut Corporation to provide economic development in Adak.

The Aleutian Basin pollock stock is at low levels. Biomass in the Aleutian Basin area is estimated by the hydroacoustic survey in the Bogoslof area. Biomass in the Bogoslof area declined from 2,400,000 mt in 1988 to only 54,000 mt in 1994. The projected 2004 exploitable biomass was 227,000 mt. This stock has historically contributed to the fishery in the international waters of the central Bering Sea (the Donut Hole

fishery), which provided catches of 1.0 to 1.4 million mt during the years 1986 through 1989. No directed fishing has occurred on this stock since 1991.

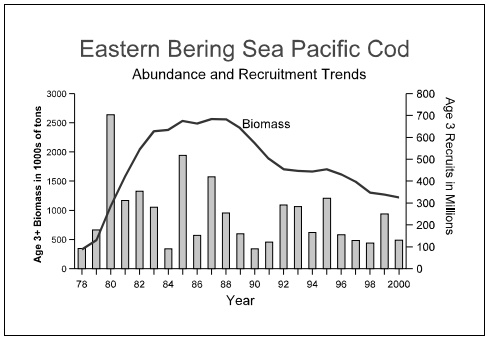
The BSAI pollock TAC has been allocated between inshore and offshore trawl fishing sectors since 1992. The American Fisheries Act (AFA) of 1998 established specific allocations for the pollock TAC: 10% to the community development quota program, with the remainder allocated 50% to catcher vessels delivering inshore, 40% to catcher processors processing offshore, and 10% to catcher vessels delivering to motherships. The Act also established the authority and mechanisms for pollock fishery cooperatives (for further information, see Appendix C).

In 1990, roe-stripping of pollock was prohibited, and the Bering Sea pollock fishery was divided into roe and non-roe fishing seasons. The pollock fishery has also been affected by management measures designed to protect Steller sea lions since 1992. Temporal and spatial dispersion of the fleet has been accomplished through fishery exclusion zones around rookeries or haulout sites, phased in reduction in the seasonal proportions of TAC that can be taken in Steller sea lion critical habitat, and additional seasonal TAC allocations.

Measures have also been implemented to reduce bycatch in the pollock fishery. Bycatch limits for chum salmon (42,000 fish), Chinook salmon (29,000 fish), and herring (1% of total BSAI herring biomass) trigger area closures for the pollock fisheries in particular (see Section 3.6). Beginning in 1998, 100% retention was required for pollock under the improved retention/improved utilization (IR/IU) program. In 1999, the use of bottom trawl gear for directed pollock fishing was prohibited, to reduce bycatch of halibut and crabs.

4.1.2.2 Pacific Cod

The BSAI Pacific cod stock increased to high levels in the mid 1990s, then declined. The 2000 year class was above average, with recruits into the fishery beginning in 2003. Significant uncertainty surrounds the maximum permissible ABC computed in the stock assessment model. Between 1998 and 2002, the ABC below the maximum permissible. In 2003 and 2004, Council, with advice from the Groundfish Plan Team and the SSC, instead selected an ABC through an alternative ‘constant catch’ approach, as the resulting ABC is at least as conservative as under the previous approach.



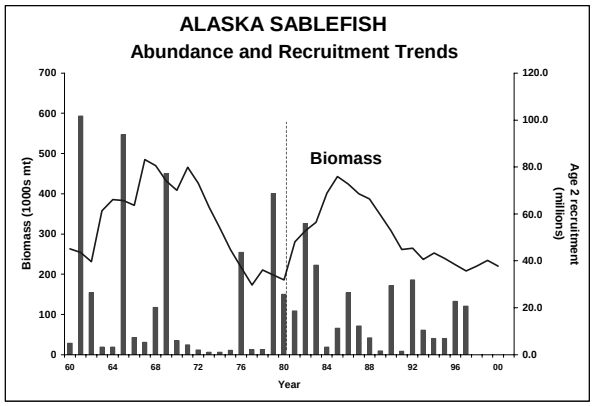
Projected age 3+ biomass and ABC (mt) of BSAI Pacific cod.

Year	Biomass	ABC
2002	1,540,000	223,000
2003	1,680,000	223,000
2004	1,660,000	223,000

The BSAI Pacific cod TAC is not apportioned by area, but is currently allocated 2 percent to jig gear, 51 percent to fixed gear, and 47 percent to trawl gear. The fixed gear allocation is seasonally apportioned by trimester. Any unused TAC from the jig gear quota becomes available to fixed gear on September 15. 80 percent of the fixed gear apportionment is reserved for longline catcher/processors, 0.3 percent for longline catcher vessels, 15 percent for pot catcher vessels, 3.3 percent for pot catcher/processors, and 1.4 percent for fixed gear catcher vessels less than 60' length overall. Beginning in 1998, 100% retention was required for Pacific cod under the IR/IU program.

4.1.2.3 Sablefish

Sablefish in the Bering Sea, Aleutian Islands, and Gulf of Alaska are considered to be of one stock. The resource is managed by region in order to distribute exploitation throughout its range. Large catches of sablefish (up to 26,000 mt) were made in the Bering Sea during the 1960s, but have declined considerably. Since 1991, catch has rarely exceed 1,000 mt. Catch in the Aleutian Islands has never exceeded 3,600 mt, and in the early 2000s has hovered at around 1,000 mt. Biomass of the sablefish stock off Alaska appears low and stable.



Projected age 4+ biomass and ABC (mt) of BSAI sablefish.

Year	Biomass	ABC
2002	188,000	12,820
2003	182,000	14,890
2004	179,000	16,550

The TAC for sablefish is apportioned among gear types. Sablefish in the Bering Sea is allocated 50% to fixed gear and 50% to trawl gear. In the Aleutian Islands, the sablefish TAC is allocated 75% to fixed gear and 25% to trawl gear. Twenty percent of the fixed gear allocations is reserved for use by community development quota program participants. The remaining fixed gear apportionment of the sablefish TAC is managed under an individual fishing quota (IFQ) program, which began in 1995. Important, although small, state water open access sablefish fisheries occur in the Aleutians.

4.1.2.4 Flatfish

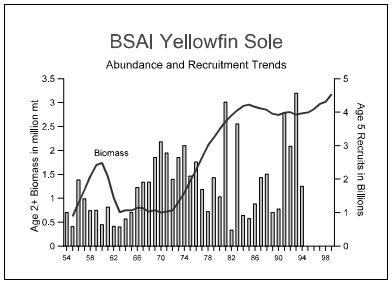
After pollock, flatfish species comprise a large proportion of groundfish exploitable biomass in the BSAI. Dominant species are yellowfin sole and rock sole. Other abundant or commercially important BSAI flatfish species are Greenland turbot, arrowtooth flounder, flathead sole, and Alaska plaice.

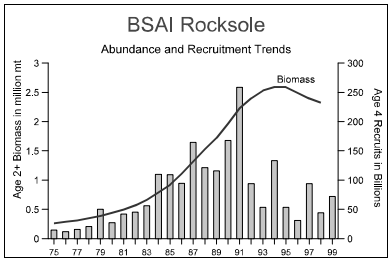
Projected biomass and ABC (mt) of BSAI flatfish, 2004.

Species	Biomass	ABC
yellowfin sole	1,560,000 [1]	114,000 [3]
Greenland turbot	132,000 [2]	
arrowtooth flounder	696,000 [2]	115,000
rock sole	1,160,000 [1]	139,000
flathead sole	505,000 [4]	61,900
Alaska plaice	1,050,000 [2]	203,000
other flatfish	90,300 [2]	13,500

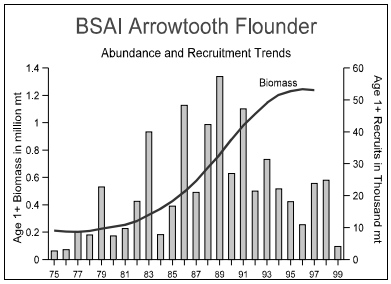
[1]age 2+ biomass
[2]age 1+ biomass
[3]Greenland turbot ABC is apportioned by subarea.
[4]age 3+ biomass

As of 2004, the biomass of most BSAI flatfish stocks remains relatively high. For many flatfish species, recruitment in more recent years has been low; consequently, stock declines are expected in coming years. The yellowfin sole stock has been declining since the mid-1980s, however the possibility of the 1995 year class being above average suggests that the stock may be more stable in the near future. Although biomass of rock sole increased from 2002 to 2003, it is expected to decline over the next few years. Recruitment of Alaska plaice has been stable since the late 1970s. The eastern Bering

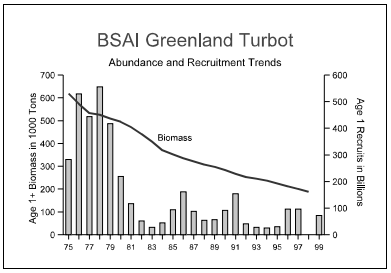




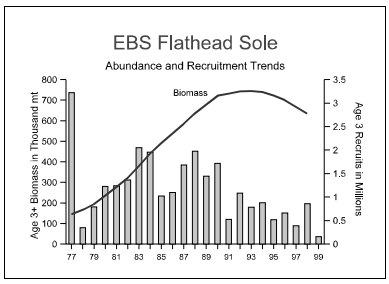
Sea bottom trawl survey for 2003 estimated a decrease in biomass for the 'other flatfish' stocks of 8 percent over 2002.



Yellowfin sole and arrowtooth flounder are caught primarily with bottom trawl gear. Rock sole are important as the target of a high value roe fishery in February and March that accounts for the majority of the annual catch. Arrowtooth flounder has a low perceived commercial value, despite research in the early 1990s on their commercial utilization (Hiatt et al. 2003). This results in high discard rates. Alaska plaice is also a little utilized species, with a retention rate in 2002 of only 3%. The principle species of the 'other flatfish' group are starry flounder and rex sole; these species contributed 85% of the 'other flatfish' harvest in 2003.



Other than yellowfin sole, flatfish species as a whole are lightly harvested. This is due primarily to halibut and crab bycatch limits, which frequently close down the fisheries prior to the achievement of TAC. Additionally, the Council frequently sets conservative quotas for these fisheries, at levels significantly less than their ABCs, because they are unlikely to achieve their TACs and that OY quota can instead be set for more highly valued species such as pollock, Pacific cod, and yellowfin sole.



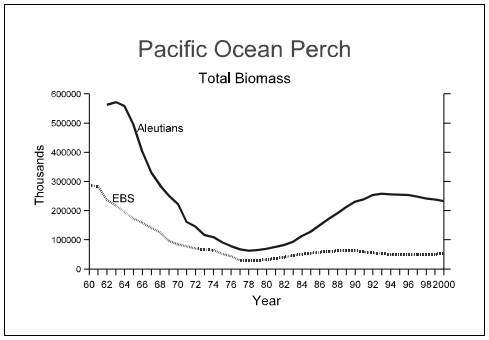
Unlike biomass of other BSAI flatfish species, biomass of Greenland turbot is at low levels and declining. Biomass has declined due to poor year classes from 1981-1997. Catch has also declined from a peak of 57,000 mt in 1981. Since the 1990s, the Council has set low TACs (7,000 mt or lower) for Greenland turbot as an added conservation measure due to concerns about low recruitment. Biomass is projected to continue declining despite conservative management. The ABC for Greenland turbot is allocated by subarea, based on the proportion of biomass in each area. In 2004, the ABC for the Aleutian Islands was 1,578 mt (33% of the total), and for the Bering Sea was 3,162 mt. Greenland turbot were harvested almost exclusively (>90%) by trawl gear until the early 1990s when longlines became the dominant gear type for this species. No halibut bycatch has been apportioned for a directed trawl fishery since 1996, effectively prohibiting this gear type from targeting turbot.

4.1.2.5 Pacific Ocean Perch

Pacific ocean perch (commonly referred to by its acronym POP) are the dominant red rockfish species in the north Pacific. They are caught primarily along the Aleutian Islands, and to a lesser extent in the eastern Bering Sea and Gulf of Alaska. Heavy exploitation by foreign fleets resulted in peak catches of 47,000 mt in the

Projected age 3+ biomass (mt) of Pacific ocean perch in the BSAI.

Year	Biomass
2002	337,000
2003	375,000
2004	349,000



eastern Bering Sea in 1961, and 109,100 mt in 1965 in the Aleutian Islands, and subsequent biomass declines. Above average year classes in the early 1980s has boosted biomass levels, which have remained relatively stable since 1995.

ABCs and TACs for POP are apportioned by subarea, and for the Aleutian Islands, are further allocated by district. In 2004, the ABC for POP was 2,128 mt in the Bering Sea, 3,059 mt in the eastern Aleutian Islands, 2,926 in the central Aleutian Islands, and 5,187 in the western Aleutian Islands.

Survey biomass and ABC (mt) of BSAI rockfish, 2004.

Species	Biomass	ABC
northern rockfish	142,000	68,801
shortraker rockfish	23,400	526
rougheye rockfish	10,400	195
eastern Bering Sea 'other rockfish'	18,300	960
Aleutian Islands 'other rockfish'	12,100	634

[1]ABC is apportioned by subarea

4.1.2.6 Other Rockfish

Rockfish other than Pacific ocean perch were divided into two complexes, the other red rockfish complex and the other rockfish complex, through 2000. Since 2001, northern, shortraker and rougheye rockfish have been managed as separate species in order to manage them more consistently.

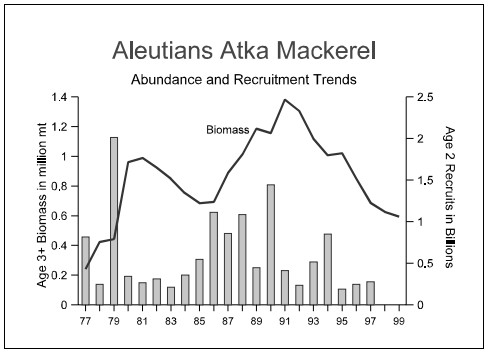
In the early 2000s, approximately 90 percent of northern rockfish were harvested in the Atka mackerel bottom trawl fishery, mainly in the Western Aleutian Islands district. Compared to northern rockfish, shortraker rockfish, and rougheye rockfish are a relatively high valued species, and consequently are less frequently discarded.

Since 1998, the Aleutian Islands TAC for shortraker/rougheye rockfish is allocated between trawl and fixed gear fisheries. Since 2001, shortraker and rougheye rockfish have been allocated separate TACs. Thirty percent of the TAC is allocated to fixed gear and 70 percent to vessels using trawl gear.

The "other rockfish" category contains eight rockfish species; the most abundant members are shortspine thornyhead and light dusky. Shortspine thornyheads are a higher priced species, and are caught mainly by fixed gear rather than trawl fisheries. The ABCs for the complex are listed in the box above.

4.1.2.7 Atka Mackerel

Atka mackerel are found along the Aleutian Islands, and to a lesser extent in the western Gulf of Alaska. Biomass increased from 1977 to a peak in 1992, declined over the 1990s, and has since increased. Catches have been relatively high since 1992, in response to evidence of a large exploitable biomass in the central and western Aleutian Islands; a record 103,000 mt was harvested in 1996. The Atka mackerel fishery takes place primarily with bottom trawl gear at depths of less than 200 m. The fishery is highly localized and takes place in the same few locations each year.



Projected age 3+ biomass (mt) of BSAI Atka mackerel.

Year	Biomass
2002	440,000
2003	358,000
2004	286,000

In 1993, TAC allocations in the Aleutian Islands subarea was divided into districts, in part to allows localized management. In 2004, the ABCs for Atka mackerel were 11,240 mt in the combined Eastern Aleutian Islands/Bering Sea subarea, 31,100 in the Central Aleutian Islands, and 24,360 in the Western Aleutian Islands.

Since 1998, Atka mackerel have also been allocated by gear. A total of 1% of the combined Eastern Aleutian Islands/Bering Sea subarea TAC is allocated to jig gear. Once the jig fleet takes its 1% allocation, its allocation will increase to 2% for future years.

Atka mackerel are an important prey for Steller sea lions, and management measures have been taken to reduce the impacts of an Atka mackerel fishery on Steller sea lions. Since June 1998, the Atka mackerel fishery has been dispersed, both temporally and spatially, to reduce localized depletions of Atka mackerel. The TAC is now be equally split into two seasons, and the amount taken within sea lion critical habitat is limited.

4.1.2.8 Squid

There is no reliable estimate of squid abundance in the eastern Bering Sea. As a result, squid is managed in Tier 6 of the overfishing definitions, such that the overfishing level and ABC is based on catch history between 1978 and 1995. The BSAI ABC for squid is set at 1,970 mt.

Squid were a target fishery in the late 1970s and early 1980s for Japanese and Korean trawl vessels. Catches peaked at 6,886 mt in the eastern Bering Sea and 2,332 mt in the Aleutian Islands during this time. While not a target of the domestic fisheries, squid are taken incidentally in the target fisheries for pollock. Between 2001 and 2003, total catch averaged about 1,400 mt in the eastern Bering Sea, and was negligible in the Aleutian Islands. Discard rates of squid in the other target groundfish fisheries ranged between 40 and 85 percent during 1992-1998.

4.2 Habitat

The most prominent and unique feature of the BSAI management area 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 km^2 area is continental shelf, 13% continental slope, and 43% deepwater basin (Figure 4-1). 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).

The Aleutian-Commander Islands arc forms a partial barrier to the exchange of Bering Sea and Pacific Ocean water. This chain is made up of more than 150 islands and has a total length of approximately 2,260 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 Aleutian Islands.

An additional geographical feature of the Aleutian Islands 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 800-1,000 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 (Figure 4-2). 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.

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.

Figure 4-1 Bathymetric map of the Bering Sea (Sayles 1979).

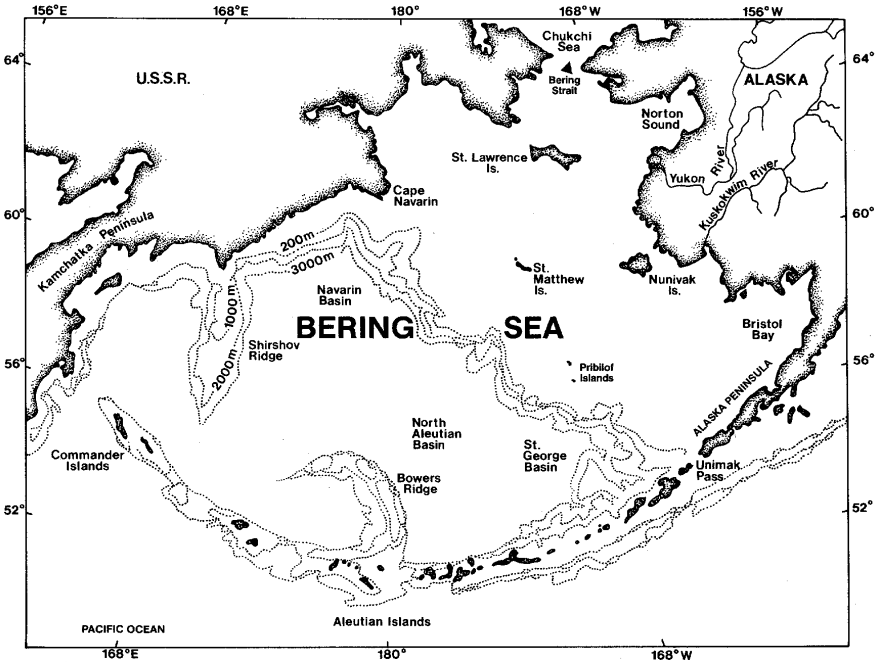
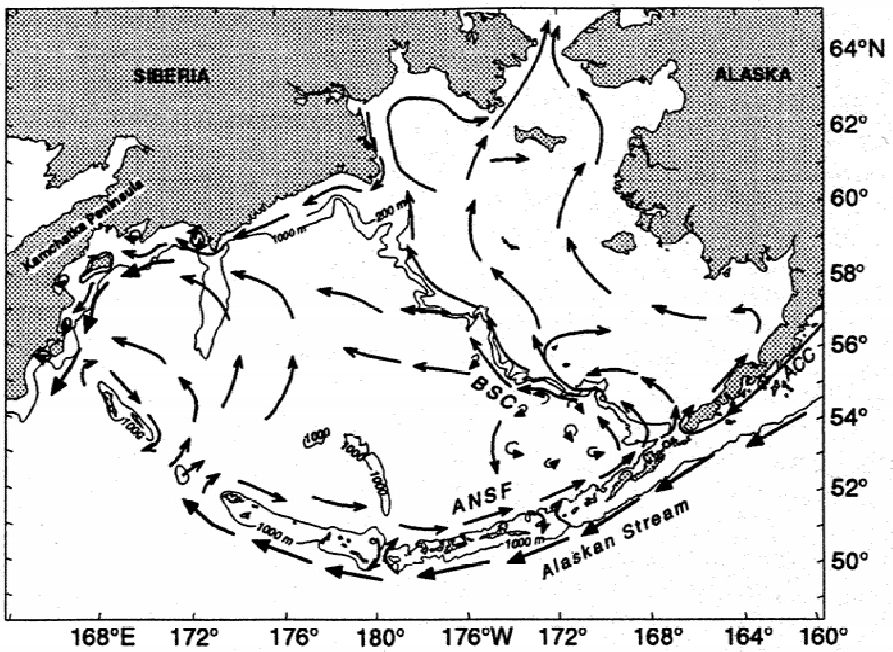


Figure 4-2 Currents in the Bering Sea (Stabeno et al. 1993). Schematic of mean circulation in the upper 40 m of the Bering Sea water column over the basin and shelf (after Stabeno and Reed 1994, Schumacher and Stabeno 1998). The arrows with solid heads represent currents with mean speeds typically >50 cm/s. The Alaskan Stream, Kamchatka Current, Bering Slope Current (BSC), and Aleutian North Slope Current (ANSF) are each indicated. The 100-m flow and 1,000-m isobath are indicated.



4.2.1 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 4-1). 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 4-3). 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.

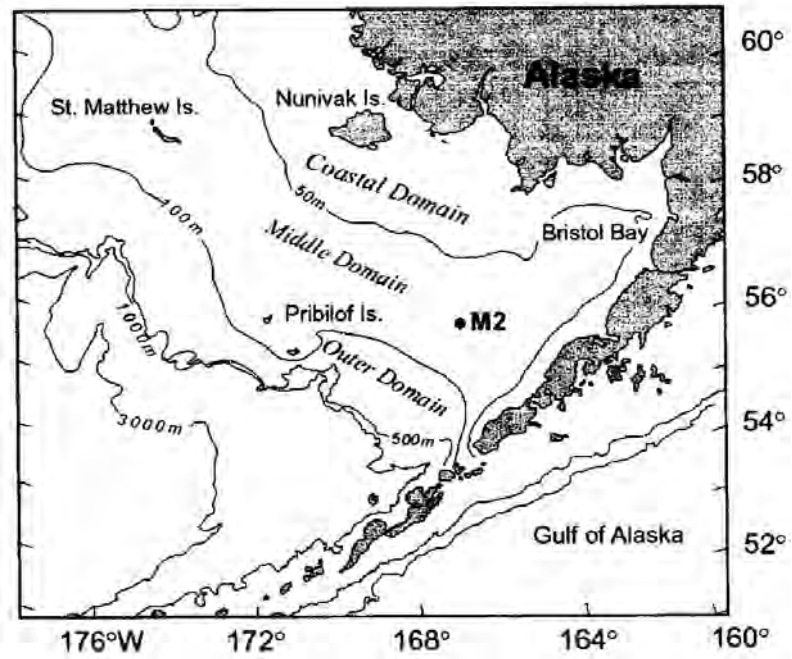
Net circulation in the Bering Sea is generally sluggish. However, moderate to strong tidal and wind-driven currents can be established over the shelf. Nearshore coastal currents from the Gulf of Alaska shelf flow into the Bering Sea through Unimak Pass and then apparently continue northeastward along 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 outershelf 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.

Table 4-1 Characteristic Features of the Eastern Bering Sea Shelf Ecosystem (Favorite and Laevastu 1981).

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 and out) caused by ice • Limited production in winter
Cold bottom water	• Out migration of biota • Higher mortalities and lower growth of benthic and demersal biota • Accumulation of generations
High runoff	• Low salinities (near coasts) • High turbidities • Presence of euryhaline fauna
Sluggish circulation	• Local biological production • Local pelagic spawning
BIOLOGICAL FEATURES	
High production and slow turnover	• High standing stocks
Fewer species than in lower latitudes	• Few species quantitatively very dominant
High amounts of marine mammals and birds	• High predation by apex predators
Pronounced seasonal migrations	• Great local space and time changes of abundance
FISHERIES RESOURCE FEATURES	
Pollock dominate semidemersal species	• Flexible feeding and breeding habits, especially environmental adaptation
Yellowfin sole dominate demersal species	• Abundant benthos food supply
Herring and capelin dominate pelagic species	• Important forage species in the ecosystem
Abundant crab resources	• Large, relatively shallow shelf. Few predators on adults, especially environmental adaptation.
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 and birds. Very limited local fisheries, no pollution.

Figure 4-3 Hydrographic domains in the Bering Sea (Hunt and Stabeno 2002), with 50, 100, 200, and 1,000 m isobaths.



4.2.2 Essential Fish Habitat Definitions

For each groundfish species, the amount of information available on the distribution of a life stage is indicated by the level to which it is classified (Table 4-2). A summary of the habitat information levels for each species is listed in Table 4-3. A detailed description of life history features and habitat requirements of FMP species is contained in Appendix D. Appendix E includes the maps of EFH for the species described in this section.

Table 4-2 Classification of EFH levels

Level 0	No systematic sampling has been conducted for this species and life stage; may have been caught opportunistically in small numbers during other research.
Level 0_a	Some information on a species' life stage upon which to infer general distribution.
Level 0_b	No information on the life stage, but some information on a similar species or adjacent life stage from which to infer general distribution.
Level 0_c	No information on the actual species' life stage and no information on a similar species or adjacent life stages, or where complexity of a species stock structure prohibited inference of general distribution.
Level 1	Distribution data are available for some or all portions of the geographic range of the species.
Level 2	Habitat-related densities of the species are available
Level 3	Growth, reproduction, or survival rates within habitats are available
Level 4	Production rates by habitat are available

Table 4-3 Levels of essential fish habitat information currently available for BSAI groundfish, by life history stage. Juveniles were subdivided into early and late juvenile stages based on survey selectivity curves.

Species	Eggs	Larvae	Early Juveniles	Late Juveniles	Adults
Pollock	1	1	1	1	2
Pacific cod	0_a	0_a	0_a	1	2
Sablefish	0_a	0_a	0_a	1	2
Yellowfin sole	0_a	0_a	0_a	1	2
Greenland turbot	0_a	0_a	0_a	1	2
Arrowtooth flounder	0_a	0_a	0_a	1	2
Rock sole	0_a	0_a	0_a	1	2
Flathead sole	0_a	0_a	0_a	1	2
Other flatfish	0_a	0_a	0_a	1	2
Pacific ocean perch	-	0_a	0_a	1	1
Northern rockfish	-	0_b	0_b	1	1
Shortraker rockfish	-	0_b	0_{a-b}	0_b	1
Rougheye rockfish	-	0_b	0_{a-b}	1	1
Dusky rockfish	-	0_b	0_b	0_a	1
Thornyhead rockfish	0_a	0_a	0_a	0_a	1
Atka mackerel	0_a	0_a	0_b	0_b	2
Squid	0_a	-	0_a	0_a	0_a
Other species					
sculpins	0_a	0_a	0_a	0_a	1
skates	0_a	-	0_a	0_a	1
sharks	-	-	0_a	0_a	0_a
octopus	0_a	-	0_a	0_a	0_a
Forage fish species					
eulachon and capelin	0_a	0_a	0_a	0_a	0_a
myctophids and bathylagids	0_c	0_c	0_a	0_a	0_a
sand lance	0_a	0_a	0_a	0_a	0_a
sand fish	0_a	0_c	0_a	0_a	0_a
pholids and stichaeids	0_c	0_c	0_a	0_a	0_a
gonostomatids	0_c	0_c	0_c	0_c	0_a
euphausiids	0_a	0_a	0_a	0_a	0_a

NOTE: '-' indicates a species that has internal fertilization and bears live young.

4.2.2.1 Walleye Pollock

Eggs (duration 14-25 days) - Level 1: Pelagic waters of the outer continental shelf and upper slope of the eastern Bering Sea from Unimak Island northwest to Zhenchug Canyon. Also in pelagic waters (200-400 m depth) over basin and lower slope areas in the Aleutian Islands and the Aleutian Basin. These are likely areas of upwelling or have gyres. Spawning occurs in February-April.

Larvae (duration 60 days) - Level 1: Epipelagic waters on the inner, middle, and outer continental shelf and upper slope throughout the eastern Bering Sea, eastern portions of the Aleutian Basin and throughout the Aleutians Islands. Survival is enhanced where food (copepod nauplii and small euphausiids) is concentrated, such as along semi-permanent fronts (mid-shelf front near the 100 m isobath) in the eastern Bering Sea, within ephemeral gyres, and possibly in association with jellyfish.

Juveniles (up to 4 years) - Level 1: Throughout the eastern Bering Sea and the Aleutian Islands both pelagically and on-bottom (no known substrate preferences) throughout the inner, middle, and outer shelf regions. At ages 2 and 3 years, pollock are located off-bottom within the water column, principally in the middle and outer shelf regions northwest of the Pribilof Islands. Ranges of juveniles of strong year-classes have varied from throughout the eastern Bering Sea (1978 year-class) to almost exclusively north of Zhenchug Canyon (1989 year-class). Feeding areas contain pelagic crustaceans such as copepods and euphausiids.

Adults (4+ years old) - Level 2: Meso-pelagic and semi-demersal habitats (no known substrate preferences) along the middle and outer continental shelf in the eastern Bering Sea from the U.S. Russia Convention Line to Unimak Pass and northeast along the Alaska Peninsula and throughout the Aleutian Islands. Also exists pelagically over deep Aleutian basin waters. Feeding areas are those that concentrate pelagic crustaceans (e.g., euphausiids) and juvenile fish (primarily juvenile pollock), such as in upwelling regions along the shelf break or fronts on the middle shelf. Known spawning areas in the eastern Bering Sea are: north of Unimak Island, along the mid-shelf front (100 m isobath)between Unimak Island and the Pribilof Islands, south of the Pribilof Islands, and possibly at other areas to the north, particularly at heads of submarine canyons. Known spawning areas in the Aleutian Islands are: over deep waters north of Umnak and Unalaska Islands, the region north of the Islands of Four Mountains, through Amukta Pass to Seguam Island, and north of Kanaga and Tanaga Islands. Pollock may prefer waters of 2-3°C for spawning.

4.2.2.2 Pacific Cod

Eggs (duration 15-20 days) - Level 0_a: Areas of mud and sand on the inner, middle, and outer continental shelf and upper slope throughout the eastern Bering Sea and Aleutian Islands in winter and spring.

Larvae (duration unknown) - Level 0_a: Epipelagic waters throughout the eastern Bering Sea and Aleutian Islands regions in winter and spring.

Early Juveniles (up to 2 years) - Level 0_a: Areas of mud and sand and the water column on the inner and middle continental shelf of the eastern Bering Sea and Aleutian Islands, particularly those with mysids, euphausiids and shrimp.

Late Juveniles (2-4 years) - Level 1: Areas of soft substrate (clay, mud, and sand) and the lower portion of the water column on the inner, middle, and outer continental shelf areas of the eastern Bering Sea and Aleutian Islands, particularly those with mysids, euphausiids, shrimp, pollock, flatfish, crab, and fishery discards.

Adults (4+ years old) - Level 2: Areas of mud and sand along the inner, middle, and outer continental shelf up to 500m along with the lower portion of the water column of the eastern Bering Sea and Aleutian Islands. Spawning occurs in January-May near the bottom across broad areas of the shelf, but predominately along the outer shelf between 100-200 m in the eastern Bering Sea, and throughout the area <200 m in the Aleutian Islands. After spawning, the mature population spreads out throughout the shelf in the eastern Bering Sea and Aleutian Islands, but with concentrations along the outer shelf northwest of the Pribilof Islands and along the outer and middle shelf areas northwest of the Alaskan Peninsula and into Bristol Bay. Feeding areas contain pollock, flatfish, and crab.

4.2.2.3 Sablefish

Eggs (duration 14-20 days) - Level 0_a: Pelagic waters of the upper and lower slope, and basin areas from 200-3000 m from late winter to early spring (December-April) in the eastern Bering Sea and Aleutian Islands.

Larvae (duration up to 3 months) - Level 0_a: Epipelagic waters of the middle and outer continental shelf, the slope and basin areas in the BSAI during late spring-early summer months (April - July).

Early Juveniles (up to 2 years) - Level 0_a: Pelagic waters, during first summer, along the outer, middle, and inner continental shelf of the BSAI. Areas of soft-bottom in nearshore bays and island passes after the first summer until end of second summer.

Late Juveniles (2-5 years) - Level 1: Areas of soft bottom deeper than 200 m associated with the continental slope and deep shelf gulleys and fjords (presumably within the lower portion of the water column) of the BSAI. Feeding areas contain mesopelagic and benthic fishes, benthic invertebrates and jellyfish.

Adults (5+years) - Level 2: Areas of soft bottom deeper than 200 m (presumably within the lower portion of the water column) associated with the continental slope and deep shelf gulleys in the BSAI. Feeding areas contain mesopelagic and benthic fishes, benthic invertebrates and jellyfish. A large portion of the adult diet is comprised of gadid fishes mainly pollock.

4.2.2.4 Yellowfin Sole

Eggs (duration unknown) - Level 0_a: Pelagic inshore waters of the southeastern Bering Sea shelf from Norton Sound to Bristol Bay in spring and summer.

Larvae (duration 2-3 months) - Level 0_a: Pelagic inshore waters of the southeastern Bering Sea shelf from Norton Sound to Bristol Bay in spring, summer and fall.

Early Juveniles (to 5.5 years old) - Level 0_a: Demersal areas (bottom and lower portion of the water column) on the inner, middle and outer portions of the continental shelf (down to 250 m) and within nearshore bays of the eastern Bering Sea.

Late Juveniles (5.5-9 years old) - Level 1: Areas of sandy bottom along with the lower portion of the water column within nearshore bays and on the inner, middle and outer portions of the continental shelf (down to 250 m) of the eastern Bering Sea south of St Matthew Island (approximately 61° N) and in Norton Sound. Feeding areas contain polychaetes, bivalves, amphipods and echiurids.

Adults (9+ years old) - Level 2: Areas of sandy bottom along with the lower portion of the water column on the inner, middle and outer portions of the continental shelf (down to 250 m) of the eastern Bering Sea south of St. Matthew Island (approximately 61° N) and in Norton Sound. Areas of known concentrations vary seasonally. Adult spawning areas in summer (May-August) are located along the inner shelf from Cape Constantine to Cape Peirce, throughout Kuskokwim Bay, and North of Nunivak Island. Summer (June-October) feeding concentrations of adults are located along the inner and middle portions of the shelf from Kuskokwim and Bristol Bays south along the Alaskan Peninsula to Amak Island, and northwest to St. Matthew Island. Feeding areas contain polychaetes, bivalves, amphipods and echiurids. In winter, yellowfin sole adults migrate to deeper waters of the shelf (100-200 m) south of 60°N to the Alaskan Peninsula.

4.2.2.5 Greenland Turbot

Eggs (duration unknown) - Level 0_a: Benthypelagic waters of the outer continental shelf and slope in the eastern Bering Sea and throughout the Aleutian Islands.

Larvae (8-9 months) - Level 0_a: Pelagic waters of the outer continental shelf, slope, and adjacent basin in the eastern Bering Sea and throughout the Aleutian Islands.

Early Juveniles (to 4 years old) - Level 0_a: Substrate and lower portion of the water column of the inner, middle and outer portions of the continental shelf and the adjacent upper slope region of the eastern Bering Sea and throughout the Aleutian Islands.

Late Juveniles (4-5 years old) - Level 1: Substrate (particularly mud and muddy-sand) and lower portion of the water column of the middle and outer continental shelf and adjacent upper and lower slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Feeding areas contain euphausiids, polychaetes, and small fish.

Adults (5+ years old) - Level 2: Substrate (particularly mud and muddy-sand) and lower portion of the water column of the outer continental shelf and adjacent upper and lower slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Annual spring and fall migrations from deeper to shallower waters. Feeding areas contain pollock and small fish.

4.2.2.6 Arrowtooth Flounder

Eggs (duration unknown) - Level 0_a: Pelagic waters of the middle and outer continental shelf and slope in the eastern Bering Sea and throughout the Aleutian Islands in winter.

Larvae (duration 2-3 months) - Level 0_a: Pelagic waters of the inner, middle and outer continental shelf and adjacent nearshore bays in the eastern Bering Sea and throughout the Aleutian Islands.

Early Juveniles (to 2 years old) - Level 0_a: Areas of gravel, sand and mud and the associated water column of the inner continental shelf and the adjacent nearshore bays in the eastern Bering Sea and throughout the Aleutian Islands.

Late Juveniles (2-4 years old) - Level 1: Areas of gravel, sand and mud and the associated water column of the middle and outer continental shelf and adjacent upper slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Feeding areas contain euphausiids, crustaceans, and small fish.

Adults (4+ years old) - Level 2: Areas of gravel, sand and mud and the associated water column of the middle and outer continental shelf and adjacent upper slope regions of the eastern Bering Sea and throughout the Aleutian Islands. Summer feeding areas on the middle and outer shelf would be those containing gadids, euphausiids, and other fish. Spawning areas in winter are on the outer shelf and upper slope regions.

4.2.2.7 Rock Sole

Eggs (duration unknown) - Level 0_a: Areas of pebbles and sand on the middle and outer continental shelf in the eastern Bering Sea in winter (December-March).

Larvae (duration 2-3 months) - Level 0_a: Pelagic waters of the eastern Bering Sea over the inner, middle and outer continental shelf, the slope, and the Aleutian Basin.

Early Juveniles (to 3.5 years old) - Level 0_a: Inner, middle and outer portions of the continental shelf along with the lower portion of the water column of the eastern Bering Sea south of 61˚N and in Norton Sound. Feeding areas contain polychaetes, bivalves, amphipods and crustaceans.

Late Juveniles (3.5-8 years old) - Level 1: Areas of pebbles and sand along with the lower portion of the water column within nearshore bays and on the inner, middle and outer portions of the continental shelf of the eastern Bering Sea south of 61° N and in Norton Sound. Feeding areas contain polychaetes, bivalves, amphipods and crustaceans.

Adults (8+ years old) - Level 2: Areas of pebbles and sand along with the lower portion of the water column on the inner, middle and outer portions of the continental shelf of the eastern Bering Sea south of 61° N and in Norton Sound. Areas of known concentrations vary seasonally and include adult spawning areas in winter and feeding areas in summer (May-October), which include Bristol Bay, portions of outer Kuskokwim Bay, north of the Alaskan Peninsula to Unimak Island, and near the Pribilof Islands. Feeding areas contain polychaetes, bivalves, amphipods and crustaceans.

4.2.2.8 Flathead Sole

Eggs (duration unknown) - Level 0_a: Pelagic waters of the middle and outer portions of the southeastern Bering Sea shelf, adjacent slope and basin waters, and throughout the Aleutian Islands in winter and early spring.

Larvae (duration unknown) - Level 0_a: Pelagic waters of the inner, middle, and outer portions of the southeastern Bering Sea shelf, adjacent slope and basin waters, and throughout the Aleutian Islands in spring and summer.

Early Juveniles (to 2 years old) - Level 0_a: Bottom substrate and lower water column on the inner, middle and outer portions of the southeastern Bering Sea shelf and throughout the Aleutians Islands.

Late Juveniles (2-3 years old) - Level 1: Bottom substrate (particularly sand and mud) and lower portion of the water column on the inner, middle, and outer portions of the southeastern Bering Sea shelf south of 61˚N and throughout the Aleutian Islands. Feeding areas contain polychaetes, bivalves, ophiuroids, pollock, small tanner crab and other crustaceans.

Adults (3+ years old) - Level 2: Bottom substrate (particularly sand and mud) and lower portion of the water column on the inner, middle, and outer portions of the southeastern Bering Sea shelf south of 61˚N and throughout the Aleutian Islands. Feeding areas, primarily on the inner, middle and outer shelf in spring, summer and fall, contain polychaetes, bivalves, ophiuroids, pollock, small tanner crab and other crustaceans. Spawning areas in winter and early spring are located primarily on the outer shelf.

4.2.2.9 "Other Flatfish" - Alaska Plaice

Eggs (duration unknown) - Level 0_a: Pelagic waters of the middle and outer continental shelf of the eastern Bering Sea in spring and early summer.

Larvae (duration 2-4 months) - Level 0_a: Pelagic waters of the inner, middle and outer continental shelf of the eastern Bering Sea in summer and fall.

Early Juveniles (up to 4 years) - Level 0_a: Substrate (particularly areas of sand and mud) and lower portion of the water column on the inner and middle continental shelf of the eastern Bering Sea.

Late Juveniles (4-7 years) - Level 1: Substrate (particularly areas of sand and mud) and lower portion of the water column on the inner, middle and outer continental shelf of the eastern Bering Sea. Feeding areas contain polychaetes, amphipods, and echiurids. With increasing age, plaice overwinter near the edge of the shelf, and return to the middle and inner shelf for feeding in spring, summer and fall.

Adults (7+ years) - Level 2: Substrate (particularly areas of sand and mud) and lower portion of the water column on the inner, middle and outer continental shelf of the eastern Bering Sea. Feeding areas contain polychaetes, amphipods, and echiurids. Overwinters near the edge of the shelf in the southeastern Bering Sea from the Pribilof islands to Unimak Island and north along the Alaskan peninsula. Occurs across broad areas of the middle and inner shelf on summer and fall.

4.2.2.10 Pacific Ocean Perch

Eggs (internal incubation, ~90days) - no EFH definition determined: Internal fertilization and incubation. Incubation is assumed to occur during the winter months.

Larvae (duration 60-180 days) - Level 0_a: Pelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas of the BSAI, during the spring and summer months.

Early Juveniles (larval stage to 3 years) - Level 0_a: Initially pelagic, then demersal in very rocky areas of the inner continental shelf of the BSAI. Includes the water column.

Late Juveniles (3-10 years) - Level 1: Areas of cobble, gravel, mud, and sand along the inner, middle, and outer continental shelf and upper slope areas, shallower than adults, and the middle and lower portions of the water column of the BSAI. Feeding areas contain euphausiids.

Adults (10+ years) - Level 1: Areas of cobble, gravel, mud, and sand along the outer continental shelf and upper slope areas and middle and lower portions oft the water column of the BSAI. Feeding areas contain euphausiids. Areas of high concentrations tend to vary seasonally and may be related to spawning behavior. In summer, adults inhabit shallower depths (180-250m) and in the fall they migrate farther offshore (300-420m).

4.2.2.11 Northern Rockfish

Eggs - no EFH definition determined: Internal fertilization and incubation.

Larvae - Level 0_b: Pelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas extending to the seaward boundary of the EEZ of the BSAI, during the spring and summer months.

Early juveniles (up to 25cm) - Level 0_b: Pelagic waters and substrate of the inner, middle, and outer continental shelf of the BSAI.

Late Juveniles (greater than 25 cm) - Level 1: Areas of cobble and rock along the shallower regions (relative to adults) of the outer continental shelf of the BSAI.

Adults (13+ years) - Level 1: Areas of cobble and rock along the outer continental slope and upper slope regions and the middle and lower portions of the water column of the BSAI. Areas of relatively shallow banks of the outer continental shelf have been found to have concentrated populations.

4.2.2.12 Shortraker and Rougheye Rockfish

Eggs - no EFH definition determined: Internal fertilization and incubation.

Larvae (duration unknown) - Level 0_b: Epipelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas of the BSAI, during the spring and summer months.

Early Juveniles - Level 0_{a-b}: Pelagic waters and substrate on the entire continental shelf of the BSAI.

Late Juveniles - Level 0_b and Level 1: Areas shallower than adult along the continental shelf of the BSAI. Juvenile shortraker rockfish have been only rarely seen.

Adults (15+ years) - Level 1: Areas of mud, sand, rock, cobble, and gravel and the lower portion of the water column on the outer continental shelf and upper slope of the BSAI. Fishery concentrations at 100-500 m. Feeding areas contain shrimps, squid and myctophids.

4.2.2.13 "Other Rockfish"

<u>Dusky rockfish</u>

Eggs - no EFH definition determined: Internal fertilization and incubation.

Larvae - Level 0_b: Pelagic waters of the inner, middle, and outer continental shelf, the upper and lower slope and the basin areas extending to the seaward boundary of the EEZ of the BSAI, during the spring and summer months.

Early juveniles (up to 25cm) - Level 0_b: Pelagic waters of the inner, middle, and outer continental shelf of the BSAI.

Juveniles (greater than 25cm) - Level 0_a: Areas of cobble, rock and gravel and the water column along the inner, middle, and outer continental shelf of the BSAI.

Adults (up to 50 years) - Level 1: Areas of cobble, rock and gravel along the outer continental shelf and upper slope region and the middle and lower portions of the water column of the BSAI. Feeding areas contain euphausiids.

<u>Thornyhead rockfish</u>

Eggs - Level 0_a: Pelagic waters of the BSAI during the late winter and early spring.

Larvae (duration <15 months) - Level 0_a: Pelagic waters of the BSAI.

Juveniles (>15 months) - Level 0_a: Areas of mud, sand, rock, cobble, and gravel and the lower portion of the water column along the middle and outer continental shelf and upper slope of the BSAI.

Adults (12+ years) - Level 1: Areas of mud, sand, rock, cobble, and gravel and the lower portion of the water column along the middle and outer continental shelf and upper and lower slope of the BSAI. Feeding areas contain shrimp, fish (cottids), and small crabs.

4.2.2.14 Atka Mackerel

Eggs (duration 1-1.5 months) - Level 0_a: Areas of gravel, rock and kelp in shallow water in island passes, nearshore, and on the inner continental shelf in the Aleutian Islands and south eastern Bering Sea in areas of swift current in summer.

Larvae (duration 1.5-6 months) - Level 0_a: Epipelagic waters of the outer continental shelf of the southeastern BSAI, the Aleutian Basin (to the edge of the EEZ), and in the adjacent North Pacific Ocean (to the edge of the EEZ) in fall and winter.

Juveniles (up to 3 years) - Level 0_b: Unknown habitat association; assumed to settle near areas inhabited by adults, but have not been observed in fishery or surveys.

Adults (3+ years) - Level 2: Areas of gravel, rock and kelp on the inner, middle and outer portions of the shelf in the Aleutian Islands and the entire water column to the surface. Areas of gravel and rock on the outer portion of the shelf in the SE Bering Sea and extending nearshore near the Pribilof Islands, including the entire water column. Feeding areas contain copepods, euphausiids and meso-pelagic fish (myctophids). Spawning occurs in nearshore (inner shelf and in island passes) rocky areas and in kelp in shallow waters in summer. Move to offshore deeper areas nearby in winter. Perform diurnal/tidal movements between demersal and pelagic areas.

4.2.2.15 Squid

Red Squid

Eggs - Level 0_a: Areas of mud and sand on the upper and lower slope throughout the BSAI.

Larvae - no EFH definition determined: Not applicable (no larval stage).

Juveniles and Adults - Level 0_a: Pelagic waters of the shelf, slope and basin to the seaward edge of the EEZ in the BSAI. Feeding areas contain euphausiids, shrimp, forage fish, and other cephalopods.

4.2.2.16 "Other Species"

Sculpins

Eggs - Level 0_a: All substrates on the inner, middle and outer continental shelf of the BSAI. Some species deposit eggs in rocky shallow waters near shore.

Larvae - Level 0_a: Pelagic waters of the inner, middle and outer continental shelf and slope of the BSAI, predominately over the inner and middle shelf.

Juveniles - Level 0_a: Broad range of demersal habitats from intertidal pools, all shelf substrates (mud, sand, gravel, etc.) and rocky areas of the upper slope of the BSAI.

Adults - Level 1: Broad range of demersal habitats from intertidal pools, all shelf substrates (mud, sand, gravel, etc.) and rocky areas of the upper slope of the BSAI.

Sharks

Eggs - no EFH definition determined: Not applicable (most are oviparous).

Larvae - no EFH definition determined: Not applicable (no larval stage).

Juveniles and Adults - Level 0_a: All waters and substrate types in the inner, middle and outer continental shelf and slope of the BSAI.

Skates

Eggs - Level 0_a: All bottom substrates of the slope and across the shelf throughout the BSAI.

Larvae - no EFH definition determined: Not applicable (no larval stage)

Juveniles - Level 0_a: Broad range of substrate types (mud, sand, gravel, and rock) and the water column on the shelf and the upper slope of the BSAI.

Adults - Level 1: Broad range of substrate types (mud, sand, gravel, and rock) and the lower portion of the water column on the shelf and the upper slope of the BSAI.

Octopus

Eggs - Level 0_a: All bottom substrates of the shelf throughout the BSAI.

Larvae - no EFH definition determined: Not applicable (no larval stage).

Juveniles and Adults - Level 0_a: Broad range of substrate types (mostly rock, gravel, and sand) and the lower portion of the water column on the shelf and the upper slope of the BSAI. Feeding areas are those containing crustaceans and molluscs.

4.2.2.17 Forage Fish Complex

Eulachon

Eggs (duration 30-40 days) - Level 0_a: Bottom substrates of sand, gravel and cobble in rivers during April-June.

Larvae (duration 1-2 months) - Level 0_a: Pelagic waters of the inner continental shelf throughout the eastern Bering Sea.

Juveniles (to 3 years of age) - Level 0_a: Pelagic waters of the middle and outer continental shelf and upper slope throughout the eastern Bering Sea.

Adults (3+ years) - Level 0_a: Pelagic waters of the middle to outer continental shelf and upper slope throughout the eastern Bering Sea for non-spawning fishes (July-April). Feeding areas are those containing euphausiids and copepods. Rivers during spawning (April-June).

Capelin

Eggs (duration 2-3 weeks) - Level 0_a: Sand and cobble intertidal beaches down to 10 m depth along the shores of the eastern Bering Sea in Bristol Bay, Norton Sound, and along the northern shore of the Alaskan Peninsula during May-August.

Larvae (duration 4-8 months) - Level 0_a: Epipelagic waters of the inner and middle continental shelf throughout the eastern Bering Sea.

Juveniles (1-2 yrs) - Level 0_a: Pelagic waters of the inner and middle continental shelf throughout the eastern Bering Sea. May be associated with fronts and ice edges in winter.

Adults (2+ yrs)- Level 0_a: Pelagic waters of the inner, middle and outer continental shelf throughout the eastern Bering Sea during their non-spawning cycle (September-April). Populations associated with fronts and the ice edge formed in winter. Intertidal beaches of sand and cobble down to 10 m depth during spawning (May-August).

Myctophids and Bathylagids

Eggs - Level 0_c - no EFH definition determined: No information available at this time.

Larvae - Level 0_c - no EFH definition determined: No information available at this time.

Juveniles - Level 0_a: Pelagic waters ranging from near surface to lower portion of water column of the slope and basin regions throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean.

Adults - Level 0_a: Pelagic waters ranging from near surface to lower portion of water column of the slope and basin regions throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean.

Sand lance

Eggs (3-6 weeks) - Level 0_a: Bottom substrate of sand to sandy gravel along the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

Larvae (100-131 days) - Level 0_a: Pelagic and neustonic waters along the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

Juveniles - Level 0_a: Soft bottom substrates (sand, mud) and the entire water column of the inner and middle continental shelf throughout the eastern Bering Sea and the Aleutians Islands. Feeding areas contain zooplankton, calanoid copepods, mysid shrimps crustacean larvae, gammarid amphipods and chaetognaths.

Adults - Level 0_a: Soft bottom substrates (sand, mud) and the entire water column of the inner and middle continental shelf throughout the eastern Bering Sea and the Aleutians Islands. Feeding areas contain zooplankton, calanoid copepods, mysid shrimps crustacean larvae, gammarid amphipods and chaetognaths.

Sand fish

Eggs - Level 0_a: Egg masses attached to rock in nearshore areas throughout the eastern Bering Sea and the Aleutians Islands.

Larvae - Level 0_c - no EFH definition determined: No information available at this time.

Juveniles - Level 0_a: Bottom substrates of mud and sand of the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

Adults - Level 0_a: Bottom substrates of mud and sand of the inner continental shelf throughout the eastern Bering Sea and the Aleutians Islands.

Adults - Level 0_a: Pelagic waters throughout the eastern Bering Sea, the Aleutians Islands and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean. Dense populations are associated with upwelling or nutrient-rich areas, such as the edge of the continental shelf, heads of submarine canyons, edges of gullies on the continental shelf, in island passes along the Aleutian Islands and over submerged seamounts.

Pholids and Stichaeids

Eggs - Level 0_c - no EFH definition determined: No information available at this time.

Larvae - Level 0_c - no EFH definition determined: No information available at this time.

Juveniles - Level 0_a: Intertidal to demersal waters of the inner continental shelf with mud substrate throughout the eastern Bering Sea and the Aleutians Islands. Certain species are associated with vegetation such as eelgrass and kelp.

Adults - Level 0_a: Intertidal to demersal waters of the inner continental shelf with mud substrate throughout the eastern Bering Sea and the Aleutians Islands. Certain species are associated with vegetation such as eelgrass and kelp.

Gonostomatids

Eggs - Level 0_c - no EFH definition determined: No information is available at this time.

Larvae - Level 0_c - no EFH definition determined: No information is available at this time.

Juveniles - Level 0_c - no EFH definition determined: No information is available at this time.

Adults - Level 0_a: Bathypelagic waters throughout the eastern Bering Sea, Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean.

Euphausiids

Eggs - Level 0_a: Neustonic waters throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean in spring.

Larvae - Level 0_a: Epipelagic waters throughout the eastern Bering Sea, the Aleutians Islands, and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean in spring.

Juveniles - Level 0_a: Pelagic waters throughout the eastern Bering Sea, the Aleutians Islands and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean. Dense populations are associated with upwelling or nutrient-rich areas, such as the edge of the continental shelf, heads of submarine canyons, edges of gullies on the continental shelf, in island passes along the Aleutian Islands and over submerged seamounts.

Adults - Level 0_a: Pelagic waters throughout the eastern Bering Sea, the Aleutians Islands and to the seaward extent of the EEZ in the Bering Sea and North Pacific Ocean. Dense populations are associated with upwelling or nutrient-rich areas, such as the edge of the continental shelf, heads of submarine canyons, edges of gullies on the continental shelf, in island passes along the Aleutian Islands and over submerged seamounts.

4.2.3 Habitat Areas of Particular Concern

There are several habitat types in Alaska that have important ecological functions, are sensitive and vulnerable to human impacts, and are relatively rare. A summary of these habitat types is provided below.

4.2.3.1 Living Substrates in Shallow Waters

Habitat areas of particular concern include nearshore areas of intertidal and submerged vegetation, rock, and other substrates. These areas provide food and rearing habitat for juvenile groundfish and spawning areas of some species (e.g., Atka mackerel, yellowfin sole), and may have a high potential to be affected by shore-based activities.

Shallow inshore areas (less than 50 m depth) are very important to king crab reproduction. After molting through four larval (zoea) stages, king crab larvae develop into glaucothoe which are young crabs that settle in the benthic environment in nearshore shallow areas with significant cover, particularly those with living substrates (macroalgae, tube building polychaete worms, kelp, mussels, and erect bryozoans). The area north and adjacent to the Alaska peninsula (Unimak Island to Port Moller) and the eastern portion of Bristol Bay are locations known to be particularly important for rearing juvenile king crab.

All nearshore marine and estuarine habitats used by Pacific salmon, such as eel grass beds, submerged aquatic vegetation, emergent vegetated wetlands, and certain intertidal zones, are sensitive to natural or human induced environmental degradation, especially in urban areas and in other areas adjacent to intensive human-induced developmental activities. Many of these areas are unique and rare. The coastal zone is under the most intense development pressure, and estuarine and intertidal areas are limited in comparison with the areal scope of other marine habitats for salmon.

Herring also require shallow water living substrates for reproduction. Spawning takes place near the shoreline between the high tide level and 11 m. Herring deposit their eggs on vegetation, primarily rockweed (*Fucus* sp.) and eelgrass (*Zostera* sp.). These “seaweeds” are found along much of the Alaska coastline, but they often occur in discrete patches.

4.2.3.2 Living Substrates in Deep Waters

Habitat areas of particular concern include offshore areas with substrates of high-micro habitat diversity, which serve as cover for groundfish and other organisms. These can be areas with rich epifaunal communities (e.g., coral, anemones, bryozoans, etc.), or with large particle size (e.g., boulders, cobble). Complex habitat structures are considered most readily impacted by fishing activities (see previous sections of this document).

Corals are generally considered to be very slow growing organisms, and are a habitat of particular concern. Although scientists are not quite sure of coral's importance to fish habitat, it would certainly provide vertical structure for fish to use for protection and cover. Some observations to this claim have been provided by submersible observations. Coral habitat is likely very sensitive to human-induced environmental degradation from both fishing and non-fishing threats. It is not known how much coral there is off the coast of Alaska, but it is likely to be rare relative to other habitat types.

There are several species of deepwater coral found off Alaska. Two common species are red tree coral (*Primnoa willeyi*) and sea raspberry (*Eunephtya* sp.). Although these corals are thought to be distributed throughout the Gulf of Alaska and Aleutian Islands, much of the data analysis has focused on the eastern Gulf of Alaska. NOAA Fisheries trawl surveys have indicated high concentrations in the immediate vicinity of Dixon Entrance, Cape Ommaney, and Alsek Valley (Draft EA/RIR for Amendment 29 to the GOA Groundfish FMP, September 1992). In the GOA, NOAA Fisheries surveys have taken red tree coral in very deep areas (125-210 fathoms), whereas sea raspberries have generally been taken in shallower areas (70-110 fathoms).

Information on coral distribution has been summarized in a 1981 report by R. Cimberg, T. Gerrodette, and K. Muzik titled, “Habitat Requirements and Expected Distribution of Alaska Coral.” Though this report was written in the context of potential impacts of oil and gas exploration and development, information on habitat and distribution is relevant for our purposes. Though the report discusses coral distributions throughout Alaska, the focus here is on the information contained relevant to southeast Alaska.

The study notes that this Region probably has the largest number of coral species due to the variety of habitats in terms of depth, substrate, temperature, and currents. *Primnoa sp.*, or red tree corals, are more abundant in southeast Alaska than in any other region. Other species of fan corals have been observed as well as bamboo corals, cup corals, soft corals, and hydrocorals. The greatest number of distributional records for red tree corals are from the Gulf of Alaska, in particular from the inside waters of southeast Alaska. In southeast Alaska, red tree corals have frequently been reported in Chatham Strait, Frederick Sound, and Behm Canal. The frequency of occurrences increases toward the ocean entrances and further away from the fjords. This trend is likely due to swifter currents near the entrances and/or greater turbidity and lower salinities in the fjords. Areas of highest densities are found in regions where currents are 3/4 knots.

Distributional records were additionally analyzed relative to the depths at which they occurred. Red tree corals have been reported at depths from 10 to 800 m. The lower depth limit varied in different regions of Alaska, increasing along a geographic gradient from the Aleutians to southeast Alaska. The lower depth limit of these corals in each area corresponds with a mean spring temperature of 3.7 degrees C. The report indicates that in southeast Alaska there is a difference in the lower depth limit exhibited north of 57° latitude and that experienced south of that line (roughly running through Sitka). The data from the report indicate that, in the area of southeast Alaska north of 57°, red tree corals are predominately found between 50 and 150 meters in depth. Significant occurrences continue to exist from 150 to 250 m, and taper off rapidly beyond 250 m south of the 57° line, they occur over a broader depth range with equal occurrences from 50

to 450 m. The report indicates that other species of sea fans may be found deeper than *Primnoa sp.*, at depths up to 2,000 m.

Bamboo corals also occur in the waters of both the inside passages of southeast Alaska and in the southeast Gulf of Alaska. These corals have a lower temperature tolerance, about 3° C, and exist in depths from 300-3,500 m. These corals are also expected to exist in a rocky, stable substrate and have a low tolerance for sediments.

The depth distribution of soft corals is, like the red tree corals, expected to range from 10-800 m, though they may exist on a much wider range of substrates. Hydrocorals, also occurring in southeast Alaska, have a depth range of 700-950 m, though they may occur at shallower depths in southeast Alaska than in the more northern, colder waters.

The report notes (again in the context of potential disturbance by oil and gas exploration and development) that recolonization of tropical coral communities requires at least several decades to recover from major perturbations. Alaskan corals would likely take much longer to recolonize following similar disturbances. For example, given a predicted growth rate of 1 cm/year for *Primnoa sp.*, a colony 1 m high would require at least 100 years to return to the pre-impacted state. This, of course, is regardless of the origin of the impact.

4.2.3.3 Freshwater Areas Used by Anadromous Fish

Habitat areas of particular concern also include all anadromous streams, lakes, and other freshwater areas used by Pacific salmon and other anadromous fish (such as smelt), especially in urban areas and in other areas adjacent to intensive human-induced developmental activities.

4.2.4 Essential Fish Habitat Recommendations

Appendix F contains a description of potential adverse effects on EFH from fishing and non-fishing activities. Based on this assessment, Sections 4.2.4.1 and 4.2.4.2 contain habitat conservation and enhancement recommendations for non-fishing and fishing threats to EFH.

4.2.4.1 Habitat Conservation and Enhancement Recommendations for Non-fishing Threats to Essential Fish Habitat

Habitat alteration may lower both the quantity and quality of species production 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. Decreasing the probability of impact will lead to the highest protection of EFH. The probability of impact directly relates to the amount of human activity we introduce to an environment. Recommendations are offered to protect EFH in Tables 4-4, 4-5, and 4-6.

Table 4-4 Near Shore Habitat and Waters (0-3nm)

Recommendation	Area	Species
Minimize construction of structures such as causeways or breaches that would affect local flushing, water temperatures, water quality, lateral drift, and/or migration.	Sensitive areas, special aquatic and vegetation areas	groundfish, salmon, scallop, crab
Minimize construction of structures such as docks that ground on tidal lands during low water events.	Sensitive areas, special aquatic and vegetation areas	groundfish, salmon, crab
Minimize deposition of fill in tidelands.	Sensitive areas, special aquatic and vegetation areas	groundfish, salmon, crab
Stage rapid response equipment and establish measures for accidental impacts such as oil and hazardous material spills.	ports, sensitive areas	groundfish, salmon, scallop, crab
Monitor point source pollution sites such as fish processing waste, sewage, and storm water run off outfalls.	ports, vessel processors, communities	groundfish, salmon, scallop, crab
Minimize disposal or dumping of dredge spoils, drilling muds, and municipal and industrial wastes.	known concentration of bottom species and their habitats	groundfish, salmon, scallop, crab
Test dredge spoils prior to marine disposal	port and upland sources	groundfish, salmon, scallop, crab
Establish monitoring that incorporates Federal and State regulatory agency determinations, i.e., tracking database and GIS system	area wide	groundfish, salmon, scallop, crab

Table 4-5 Pelagic Habitat and Waters (3-12nm)

Recommendation	Area	Species
Assess cumulative oil and gas production activities.	BSAI, Chukchi Sea, OCS, Cook Inlet, GOA	groundfish, salmon, scallop, crab
Identify marine disposal sites.	area wide	groundfish, salmon, scallop, crab
Establish monitoring that incorporates Federal and State regulatory agency determinations, i.e., tracking database and GIS system	area wide	groundfish, salmon, scallop, crab
Establish no discharge zones for ballast waters to prevent introduction of non-indigenous species and chemical contaminants.	ports, known gyres areas	groundfish, salmon, scallop, crab
Minimize disposal or dumping of dredge spoils, drilling muds, and municipal and industrial wastes.	known concentration of bottom species and their habitats	groundfish, salmon, scallop, crab

Table 4-6 Offshore Habitat and Waters (>12 nm)

Recommendation	Area	Species
Establish monitoring that incorporates Federal and State regulatory agency determinations, i.e., tracking database and GIS system	area wide	groundfish, salmon, scallop, crab
Establish no discharge zones for ballast waters to prevent introduction of non-indigenous species and chemical contaminants.	known offshore gyre areas	groundfish, salmon, scallop, crab
Minimize disposal or dumping of dredge spoils, drilling muds, and municipal and industrial wastes.	known concentration of bottom species and their habitats	groundfish, salmon, scallop, crab

4.2.4.2 Habitat Conservation and Enhancement Recommendations for Fishing Threats to Essential Fish Habitat

Area closures to trawling and dredging in the BSAI area serve to protect EFH from potential adverse impacts caused by these gear types. Other management measures, such as the Pribilof Islands Habitat Conservation Area and the Bristol Bay Closure Area, are designed to reduce the impact of fishing on marine ecosystems. Catch quotas, bycatch limits and gear restrictions control removals of prey species. Studies that compare seafloor habitats in areas heavily trawled with areas that have had little trawl effort may reveal future habitat

conservation and enhancement measures necessary to protect EFH. Additionally, the annual review of existing and new EFH information during the SAFE development process is expected to identify adverse effects to EFH from fishing and proposals to amend the FMP to minimize those adverse effects. Proposals can be submitted during the Council's plan amendment cycle.

4.3 Fishing Activities Affecting the Stocks

The Bering Sea and Aleutian Islands management area is utilized primarily by commercial fisheries. The groundfish fisheries have been entirely domestic since 1991 (a history of exploitation is addressed in Section 4.3.1). The commercial fleet is described in Section 4.3.2. There is also subsistence fishing for groundfish species (Section 4.3.3) in the BSAI, although most of this activity takes place within state waters (0-3 nm). Recreational fisheries are addressed in Section 4.3.4. There are no Indian treaty fishing rights for groundfish in the BSAI exclusive economic zone (EEZ).

4.3.1 History of Exploitation

The earliest fisheries for groundfish in the BSAI were the native subsistence fisheries. The fish and other marine resources remain 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 primarily in nearshore 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 groundfish occurred in 1864 when a single schooner fished for Pacific cod in the Bering Sea. This domestic fishery continued until 1950 when demand for cod declined and economic conditions caused the fishery to be discontinued. Fishing areas in the eastern Bering Sea were from north of Unimak Island and the Alaska Peninsula to Bristol Bay. Vessels operated from home ports in Washington and California and from shore stations in the eastern Aleutian Islands. 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 between 1 and 16 up to 1914 and increased to between 13 and 24 in the period 1915-20. Estimated catches during the peak of the fishery ranged annually between 12,000-14,000 mt.

Another early fishery targeted Pacific halibut. 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. 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. The catch by North American setline vessels increased sharply between 1958 and 1963 and then declined steadily until 1972.

Several foreign countries conducted large scale groundfish fisheries in the BSAI prior to 1991. Vessels from Japan, the USSR (Russia), Canada, Korea, Taiwan, and Poland all plied the waters of the North Pacific for groundfish. In the mid 1950s, vessels from Japan and Russia targeted yellowfin sole, and catches peaked at over 550,000 mt in 1961. In the 1960s, Japanese vessels, and to a lesser extent Russian vessels, developed a fishery for Pacific ocean perch (POP), pollock, Greenland turbot, sablefish, and other groundfish. By the early 1970s, over 1.7 million mt of pollock was being caught by these two countries in the eastern Bering Sea annually. Korean vessels began to target pollock in 1968. Polish vessels fished briefly in the Bering Sea in 1973. Taiwanese vessels entered the fishery in 1977. For more information on foreign fisheries in the BSAI, refer to NPFMC (1995), Megrey and Wespestad (1990), and Fredin (1987).

The foreign fleets were phased out in the 1980s. The transition period from foreign to fully domestic groundfish fisheries was stimulated by a quick increase in joint-venture operations. The American Fisheries Promotion Act (the so-called "fish and chips" policy) required that allocations of fish quotas to foreign nations be based on the nation's contributions to the development of the U.S. fishing industry. This provided incentive for development of joint-venture operations, with U.S. catcher vessels delivering their catches directly to foreign processing vessels. Joint-venture operations peaked in 1987, giving way to a rapidly developing domestic fleet. By 1991, the entire BSAI groundfish harvest (2,126,600 mt, worth $351 million ex-vessel) was taken by only 391 U.S. vessels. Groundfish harvest has been entirely domestic since that time.

Catch History

Catch statistics since 1954 are shown for the eastern Bering Sea subarea in Table 4-7. The initial target species was yellowfin sole. During the early period of these fisheries, total catches of groundfish reached a peak of 674,000 mt in 1961. Following a decline in abundance of yellowfin sole, other species (principally walleye pollock) were targeted upon, and total catches rose to 2.2 million mt in 1972. Catches have since varied from 1 to 2 million mt as catch restrictions and other management measures were placed on the fishery.

Catches in the Aleutian Islands subarea have always been much smaller than those in the eastern Bering Sea. Target species have also been different (Table 4-8): in the Aleutians, POP was the initial target species. During the early years of exploitation, overall catches of Aleutian groundfish reached a peak of 112,000 mt in 1965. As POP abundance declined, the fishery diversified to other species. Total catches from the Aleutians in recent years have been about 100,000 mt annually.

Table 4-7a Groundfish and squid catches in the eastern Bering Sea, 1954-2002 (pollock, Pacific cod, sablefish, flatfish), in metric tons.

Year	Pollock	Pacific Cod	Sablefish	Yellowfin Sole	Greenland Turbot	Arrowtooth flounder	Rock sole[a]	Other Flatfish[a]
1954				12,562				
1955				14,690				
1956				24,697				
1957				24,145				
1958	6,924	171	6	44,153				
1959	32,793	2,864	289	185,321				
1960			1,861	456,103	36,843	[b]		
1961			15,627	553,742	57,348	[b]		
1962			25,989	420,703	58,226	[b]		
1963			13,706	85,810	31,565	[b]		35,643
1964	174,792	13,408	3,545	111,177	33,729	[b]		30,604
1965	230,551	14,719	4,838	53,810	9,747	[b]		11,686
1966	261,678	18,200	9,505	102,353	13,042	[b]		24,864
1967	550,362	32,064	11,698	162,228	23,869	[b]		32,109
1968	702,181	57,902	4,374	84,189	35,232	[b]		29,647
1969	862,789	50,351	16,009	167,134	36,029	[b]		34,749
1970	1,256,565	70,094	11,737	133,079	19,691	12,598		64,690
1971	1,743,763	43,054	15,106	160,399	40,464	18,792		92,452
1972	1,874,534	42,905	12,758	47,856	64,510	13,123		76,813
1973	1,758,919	53,386	5,957	78,240	55,280	9,217		43,919
1974	1,588,390	62,462	4,258	42,235	69,654	21,473		37,357
1975	1,356,736	51,551	2,766	64,690	64,819	20,832		20,393
1976	1,177,822	50,481	2,923	56,221	60,523	17,806		21,746
1977	978,370	33,335	2,718	58,373	27,708	9,454		14,393
1978	979,431	42,543	1,192	138,433	37,423	8,358		21,040
1979	913,881	33,761	1,376	99,017	34,998	7,921		19,724
1980	958,279	45,861	2,206	87,391	48,856	13,761		20,406
1981	973,505	51,996	2,604	97,301	52,921	13,473		23,428
1982	955,964	55,040	3,184	95,712	45,805	9,103		23,809
1983	982,363	83,212	2,695	108,385	43,443	10,216		30,454
1984	1,098,783	110,944	2,329	159,526	21,317	7,980		44,286
1985	1,179,759	132,736	2,348	227,107	14,698	7,288		71,179
1986	1,188,449	130,555	3,518	208,597	7,710	6,761		76,328
1987	1,237,597	144,539	4,178	181,429	6,533	4,380		50,372
1988	1,228,000	192,726	3,193	223,156	6,064	5,477		137,418
1989	1,230,000	164,800	1,252	153,165	4,061	3,024		63,452
1990	1,353,000	162,927	2,329	80,584	7,267	2,773		22,568
1991	1,268,360	165,444	1,128	94,755	3,704	12,748	46,681	30,401
1992	1,384,376	163,240	558	146,942	1,875	11,080	51,720	34,757
1993	1,301,574	133,156	669	105,809	6,330	7,950	63,942	28,812
1994	1,362,694	174,151	699	144,544	7,211	13,043	60,276	29,720
1995	1,264,578	228,496	929	124,746	5,855	8,282	54,672	34,861
1996	1,189,296	209,201	629	129,509	4,699	13,280	46,775	35,390
1997	1,115,268	209,475	547	166,681	6,589	8,580	67,249	42,374
1998	1,101,428	160,681	586	101,310	8,303	14,985	33,221	39,940
1999	889,589	134,647	646	67,307	5,205	9,827	39,934	33,042
2000	1,132,736	151,372	742	84,057	5,888	12,071	49,186	36,813
2001	1,387,452	142,452	863	63,563	4,252	12,836	28,949	27,693
2002	1,481,815	166,552	1,143	74,956	3,150	10,821	40,700	30,229

[a]Includes flathead sole, Alaska plaice, and "other flatfish"; also, rock sole prior to 1991 is included in catch statistics.

[b]Arrowtooth flounder is included in Greenland turbot catch statistics.

Note: Numbers do not include fish taken for research.

Table 4-7b Groundfish and squid catches in the eastern Bering Sea, 1954-2002 (rockfish, Atka mackerel, other species, total of all species), in metric tons.

Year	Pacific ocean perch complex[a]	'Other rockfish'	Atka mackerel	Squid	'Other species'	Total (all species)
1954						12,562
1955						14,690
1956						24,697
1957						24,145
1958					147	51,401
1959					380	221,647
1960	6,100					500,907
1961	47,000					673,717
1962	19,900					524,818
1963	24,500					191,224
1964	25,900				736	393,891
1965	16,800				2,218	344,369
1966	20,200				2,239	452,081
1967	19,600				4,378	836,308
1968	31,500				22,058	967,083
1969	14,500				10,459	1,192,020
1970	9,900				15,295	1,593,649
1971	9,800				13,496	2,137,326
1972	5,700				10,893	2,149,092
1973	3,700				55,826	2,064,444
1974	14,000				60,263	1,900,092
1975	8,600				54,845	1,645,232
1976	14,900				26,143	1,428,565
1977	2,654	311		4,926	35,902	1,168,144
1978	2,221	2,614	831	6,886	61,537	1,302,509
1979	1,723	2,108	1,985	4,286	38,767	1,159,547
1980	1,097	459	4,955	4,040	34,633	1,221,944
1981	1,222	356	3,027	4,182	35,651	1,259,666
1982	224	276	328	3,838	18,200	1,211,483
1983	221	220	141	3,470	15,465	1,280,285
1984	1,569	176	57	2,824	8,508	1,458,299
1985	784	92	4	1,611	11,503	1,649,109
1986	560	102	12	848	10,471	1,633,911
1987	930	474	12	108	8,569	1,639,121
1988	1,047	341	428	414	12,206	1,810,470
1989	2,017	192	3,126	300	4,993	1,630,382
1990	5,639	384	480	460	5,698	1,644,109
1991	4,744	396	2,265	544	16,285	1,647,455
1992	3,309	675	2,610	819	29,993	1,831,954
1993	3,763	190	201	597	21,413	1,674,406
1994	1,907	261	190	502	23,430	1,818,628
1995	1,210	629	340	364	20,928	1,745,890
1996	2,635	364	780	1,080	19,717	1,653,355
1997	1,060	161	171	1,438	20,997	1,640,590
1998	1,134	203	901	891	23,156	1,486,739
1999	609	135	2,008	393	17,045	1,200,387
2000	704	239	239	375	23,098	1,497,520
2001	1,148	296	264	1,761	23,148	1,694,678
2002	858	401	572	1,334	26,639	1,839,169

[a]Includes Pacific ocean perch, and shortraker, rougheye, northern, and sharpchin rockfish.

Note: Numbers do not include fish taken for research.

Table 4-8a Groundfish and squid catches in the Aleutian Islands subarea, 1962-2002 (pollock, Pacific cod, sablefish, flatfish), in metric tons.

Year	Pollock	Pacific cod	Sablefish	Yellowfin sole	Greenland turbot	Arrowtooth flounder	Rock sole	Other flatfish[a]
1962								
1963			664		7	[b]		
1964		241	1,541		504	[b]		
1965		451	1,249		300	[b]		
1966		154	1,341		63	[b]		
1967		293	1,652		394	[b]		
1968		289	1,673		213	[b]		
1969		220	1,673		228	[b]		
1970		283	1,248		285	274		
1971		2,078	2,936		1,750	581		
1972		435	3,531		12,874	1,323		
1973		977	2,902		8,666	3,705		
1974		1,379	2,477		8,788	3,195		
1975		2,838	1,747		2,970	784		
1976		4,190	1,659		2,067	1,370		
1977	7,625	3,262	1,897		2,453	2,035		
1978	6,282	3,295	821		4,766	1,782		
1979	9,504	5,593	782		6,411	6,436		
1980	58,156	5,788	274		3,697	4,603		
1981	55,516	10,462	533		4,400	3,640		
1982	57,978	1,526	955		6,317	2,415		
1983	59,026	9,955	673		4,115	3,753		
1984	81,834	22,216	999		1,803	1,472		
1985	58,730	12,690	1,448		33	87		
1986	46,641	10,332	3,028		2,154	142		
1987	28,720	13,207	3,834		3,066	159		
1988	43,000	5,165	3,415		1,044	406		
1989	156,000	4,118	3,248		4,761	198		
1990	73,000	8,081	2,116		2,353	1,459		
1991	78,104	6,714	2,071	1,380	3,174	938	n/a	88
1992	54,036	42,889	1,546	4	895	900	236	68
1993	57,184	34,234	2,078	0	2,138	1,348	318	59
1994	58,708	22,421	1,771	0	3,168	1,334	308	55
1995	64,925	16,534	1,119	6	2,338	1,001	356	47
1996	28,933	31,389	720	654	1,677	1,330	371	61
1997	26,872	25,166	779	234	1,077	1,071	271	39
1998	23,821	34,964	595	5	821	694	446	54
1999	965	27,714	565	13	422	746	577	53
2000	1,244	39,684	1,048	13	1,086	1,157	480	113
2001	824	34,207	1,074	15	1,060	1,220	526	97
2002	1,177	30,801	1,118	29	485	1,032	1,165	150

[a]Includes flathead sole, Alaska plaice, and "other flatfish".
[B]Arrowtooth flounder included in Greenland turbot catch statistics.
Note: Numbers do not include fish taken for research.

Table 4-8b Groundfish and squid catches in the Aleutian Islands subarea, 1962-2002 (rockfish, Atka mackerel, other species, total of all species), in metric tons.

Year	Pacific ocean perch complex[a]	'Other rockfish'	Atka mackerel	Squid	'Other species'	Total (all species)
1962	200					200
1963	20,800					21,471
1964	90,300				66	92,652
1965	109,100				768	111,868
1966	85,900				131	87,589
1967	55,900				8,542	66,781
1968	44,900				8,948	56,023
1969	38,800				3,088	44,009
1970	66,900		949		10,671	80,610
1971	21,800				2,973	32,118
1972	33,200		5,907		22,447	79,717
1973	11,800		1,712		4,244	34,006
1974	22,400		1,377		9,724	49,340
1975	16,600		13,326		8,288	46,553
1976	14,000		13,126		7,053	43,465
1977	8,080	3,043	20,975	1,808	16,170	67,348
1978	5,286	921	23,418	2,085	12,436	61,092
1979	5,487	4,517	21,279	2,252	12,934	75,195
1980	4,700	420	15,533	2,332	13,028	108,531
1981	3,622	328	16,661	1,763	7,274	104,199
1982	1,014	2,114	19,546	1,201	5,167	98,233
1983	280	1,045	11,585	510	3,675	94,617
1984	631	56	35,998	343	1,670	147,022
1985	308	99	37,856	9	2,050	113,310
1986	286	169	31,978	20	1,509	96,259
1987	1,004	147	30,049	23	1,155	81,364
1988	1,979	278	21,656	3	437	77,383
1989	2,706	481	14,868	6	108	186,494
1990	14,650	864	21,725	11	627	124,886
1991	2,545	549	22,258	30	91	117,942
1992	10,277	3,689	46,831	61	3,081	164,513
1993	13,375	495	65,805	85	2,540	179,659
1994	16,959	301	69,401	86	1,102	175,614
1995	14,734	220	81,214	95	1,273	183,862
1996	20,443	278	103,087	87	1,720	190,750
1997	15,687	307	65,668	323	1,555	139,049
1998	13,729	385	56,195	25	2,448	134,182
1999	17,619	630	51,636	9	1,633	102,582
2000	14,893	601	46,990	8	3,010	110,327
2001	15,588	610	61,296	5	4,029	120,551
2002	14,996	551	44,722	10	1,980	98,215

[a]Includes Pacific ocean perch, and shortraker, rougheye, northern and sharpchin rockfish.

Note: Numbers do not include fish taken for research.

4.3.2 Commercial Fishery

This section contains a general discussion of the commercial groundfish fisheries in the BSAI, including catch data for recent years. The information in this section comes from the annually updated *Stock Assessment and Fishery Evaluation* (SAFE) report (NPFMC 2003), in particular the *Economic Status of the Groundfish Fisheries off Alaska* appendix (Hiatt et al. 2003). This document is available on the Council website, or by request from the Council office. Additionally, catch data are also reported on the NOAA Fisheries Alaska region website. Website addresses for the Council and NOAA Fisheries are included in Chapter 6.

In 2002, 343 vessels participated in the groundfish fisheries in the BSAI. Of these, 163 were trawl vessels, 120 hook and line vessels, and 64 pot vessels. Total groundfish catch was 1.94 million mt, which represents approximately 92% of the total groundfish catch off Alaska. Total ex-vessel value of the BSAI groundfish catch in 2002 was $428.8 million. Pollock accounts for the largest majority of the harvest in terms of both metric tons and ex-vessel value. The groundfish fisheries off Alaska accounted for 49% of the weight and 18% of the ex-vessel value of total U.S. domestic landings, as reported in Fisheries of the United States (2002).

Walleye (Alaska) pollock (*Theragra chalcogramma*) has been the dominant species in the BSAI commercial groundfish catch. The 2002, pollock catch of 1.48 million mt accounted for 77 percent of the total BSAI groundfish catch. The next major species, Pacific cod (*Gadus macrocephalus*), accounted for 196,700 mt or about 10 percent of the total 2002 catch. The 2002 catch of flatfish, which includes yellowfin sole (*Pleuronectes asper*), rock sole (*Pleuronectes bilineatus*), and arrowtooth flounder (*Atheresthes stomias*), was 162,400 mt. Pollock, Pacific cod, and flatfish comprised 95 percent of the total 2002 BSAI groundfish catch. Other important species are sablefish (*Anoplopoma fimbria*), rockfish (*Sebastes and Sebastolobus* species), and Atka mackerel (*Pleurogrammus monopterygius*).

Trawl, hook-and-line (including longline and jigs), and pot gear account for virtually all the catch in the BSAI groundfish fisheries. There are catcher vessels and catcher processor vessels for each of these three gear groups. From 1998-2002, the trawl catch averaged about 91% of the total catch, while catch with hook-and-line gear accounted for 7.6%. During the same period, catcher vessels took 42% of the catch and catcher/processor vessels took the other 58%. Most species are harvested predominately by one type of gear, which typically accounts for 90 percent or more of the catch. The one exception is Pacific cod, where in 2002, 51% (103,000 mt) was taken by hook and line gear, 39% (79,000 mt) by trawl gear, and 10% (20,000 mt) by pots. The FMP allocates total allowable catch among gear types for pollock, sablefish, Pacific cod, Atka mackerel, and shortraker and rougheye rockfish (Section 3.2.4).

The discards of groundfish in the groundfish fishery have received increased attention in recent years by NOAA Fisheries, the Council, Congress, and the public at large. The discard rate is the percent of total catch that is discarded. For the BSAI groundfish fisheries as a whole, the annual discard rate for groundfish decreased from 14.7 percent in 1994 (total discards, 286,200 mt) to 6.1 percent in 2002 (total discards, 118,900 mt) with the vast majority of the reduction occurring in 1998. The 41 percent reduction in the BSAI discard rate from 1997 to 1998 was the result of prohibiting pollock and Pacific cod discards in the BSAI groundfish fisheries beginning in 1998. Since 1998, the discard rate has been reduced from 8.1 percent to 6.1 percent.

The bycatch of Pacific halibut, crab, Pacific salmon, and Pacific herring has been an important management issue in the commercial fishery for more than twenty years. The retention of these species was first prohibited in the foreign groundfish fisheries, to ensure that groundfish fishers had no incentive to target on these

species. Estimates of bycatch of these prohibited species are assessed annually in the *Stock Assessment and Fishery Evaluation* report. The FMP establishes catch limits for prohibited species that apply to some or all fisheries, seasons, or areas in the BSAI (Section 3.6.2). Attainment of the catch limit shuts down an area or a fishery for the remainder of the year or season. Other management measures that address prohibited species bycatch include seasonal closure areas, gear modifications, and the modification of fishing patterns as a result of share-based programs such as IFQs or cooperatives. The history of prohibited species bycatch management is reviewed in Witherell and Pautzke (1997).

An extensive at-sea observer program was developed for the foreign fleets and then extended to the domestic fishery once it had all but replaced foreign participation. The observer program resulted in fundamental changes in the nature of the bycatch program. First, by providing good estimates of total groundfish catch and non-groundfish bycatch by species, it eliminated much of the concern that total fishing mortality was being underestimated due to fish that were discarded at sea. Second, it made it possible to establish, monitor, and enforce the groundfish quotas in terms of total catch as opposed to only retained catch. For groundfish fisheries, this means that both retained catch and discarded catch are counted against TACs. Third, it made it possible to implement and enforce bycatch quotas for the non-groundfish species that by regulation had to be discarded at sea. Finally, it provided extensive information that managers and the industry could use to assess methods to reduce bycatch and bycatch mortality. In summary, the observer program provided fishery managers with the information and tools necessary to prevent bycatch from adversely affecting the stocks of the bycatch species. Therefore, bycatch in the groundfish fisheries is principally not a conservation problem, although it can be an allocation problem.

4.3.3 Subsistence Fishery

The earliest fisheries for groundfish in the BSAI were the native subsistence fisheries. Fish and other marine resources are 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 takes place in nearshore waters utilizing such species as cod, halibut, rockfish, and other species. These small-scale subsistence fisheries have continued to the present time. Although not well estimated, the total catch of groundfish in subsistence fisheries is thought to be minuscule relative to commercial fishery catches.

4.3.4 Recreational Fishery

At this time, there are essentially no recreational fisheries for groundfish species covered under this FMP. Recreational catch of groundfish in the BSAI would take place in state waters and likely fall under the classification of subsistence or personal use fisheries as regulated by Alaska state law.

4.4 Economic and Socioeconomic Characteristics of the Fishery

This section contains a general discussion of the economic and socioeconomic characteristics of the commercial groundfish fisheries in the BSAI. The information cited in this section is from the annually updated *Economic Status of the Groundfish Fisheries off Alaska* appendix to the SAFE (Hiatt et al. 2003). This document is available on the Council website, or by request from the Council office. The website address for the Council is included in Chapter 6.

Estimates of ex-vessel value by area, gear, type of vessel, and species, are included in the annual Economic Status appendix to the SAFE report. The exvessel value of the landings in the BSAI groundfish fisheries,

excluding the value added by at-sea processing, increased from $280.1 million in 1998 to $428.8 million in 2002. The distribution of ex-vessel value by type of vessels differed by area, gear, and species. In 2002, trawl gear accounted for 86 percent of the ex-vessel value of the groundfish landings compared to 92 percent of the total catch because trawl vessels take larger percentages of lower priced species such as pollock, which was $0.12 per pound in 2002. Catcher vessels accounted for 48 percent of the total ex-vessel value compared to 45 percent of the catch.

Residents of Alaska and of other states, particularly Washington and Oregon, are active participants in the BSAI groundfish fisheries. For the BSAI groundfish fisheries as a whole, 97.6 percent of the 2002 catch was made by vessels with owners who indicated that they were not residents of Alaska, accounting for 96 percent of the 2002 ex-vessel value.

Employment data for at-sea processors (but not including inshore processors) indicate that in 2002, the crew weeks totaled 97,440. The months with the highest employment occurred in February (16,501), March (16,513), and September (15,569). Much of this was accounted for by the BSAI pollock fishery.

There are a variety of at least partially external factors that affect the economic performance of the BSAI groundfish fisheries. They include landing market prices in Japan, wholesale prices in Japan, U.S. imports of groundfish products, U.S. per capita consumption of seafood, U.S. consumer and producer price indexes, foreign exchange rates, and U.S. cold storage holdings of groundfish. Exchange rates and world supplies of fishery products play a major role in international trade. Exchange rates change rapidly and can significantly affect the economic status of the groundfish fisheries.

4.5 Fishing Communities

This section contains a general discussion of the fishing communities that depend on the commercial groundfish fisheries in the BSAI. The information in this section is drawn from the *Final Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries* (NMFS 2004). This document is available on the NOAA Fisheries Alaska Region website, or by request from the NOAA Fisheries Alaska Region office. Another source of information on BSAI fishing communities is *Faces of the Fisheries*, a publication of community profiles by the Council (NPFMC 1994).

Traditionally, the dependence of BSAI coastal communities on the groundfish fisheries and fisheries affected by the groundfish fisheries has resulted from these communities being one or more of the following: 1) the home ports of vessels that participate in these fisheries; 2) the residence of participants in the harvesting or processing sectors of these fisheries; 3) the port of landings for these fisheries; 4) the location of processing plants; and 5) a service or transportation center for the fisheries. BSAI coastal communities are shown on Figure 4-4.

Many of the participants in the BSAI groundfish fisheries are not from the communities adjacent to the management area. In the BSAI, adjacent communities are small and remote. Even in the case of Unalaska and Akutan, the two BSAI communities with large groundfish processing plants, a large part of the processing plant labor force is accounted for by individuals who are neither local nor Alaska residents.

The fishery dependence of coastal and western Alaska communities was addressed through the creation of the pollock, sablefish, and halibut community development quota (CDQ) programs for the BSAI in the early to mid-1990s and the expansion of those programs into the multispecies CDQ program with the addition of all other groundfish species by 1999. The CDQ program has provided the following for the CDQ

communities: 1) additional employment in the harvesting and processing sectors of the groundfish fisheries; 2) training; and 3) income generated by fishing the CDQ allocations. In many cases, CDQ royalties have been used to increase the ability of the residents of the CDQ communities to participate in the regional commercial fisheries, or the CDQ has been fished by residents themselves. The CDQ program is discussed further in Section 4.5.4.

Figure 4-4 Bering Sea fishing communities.

[PLACEHOLDER]

4.5.1 Home Ports

Almost 100 Alaskan communities are listed as home ports. For the vast majority of the Alaska home ports, trawl vessels account for none or a very small part of the vessels and the mean length is less than 50 feet. Many of the Alaska home ports had fewer than 5 vessels. The Alaska home ports with typically more than 50 fishing vessels are as follows: Homer (100+), Juneau (200+), Kodiak (100+), Petersburg (50+), and Sitka (100+). For these five home ports, all but Kodiak had non-trawl vessels account for at least 90 percent of the vessels, and in Petersburg and Sitka almost 100 percent were non-trawl vessels. Sand Point, which typically had more than 30 vessels, was unique among Alaska home ports in that typically trawl vessels accounted for more than 50 percent of its vessels.

Vessels that participated in the BSAI and GOA groundfish fisheries had home ports in nine states other than Alaska. However, only three states had home ports for more than 2 vessels. They were: California with fewer than 20 vessels, Oregon with 42 to 75 vessels, and Washington with 310 to 423 vessels. Almost all of the non-Alaska home ports had fewer than 10 vessels and many had only a few. Seattle, with typically about 300 vessels, was the only non-Alaska port with more than 50 vessels.

4.5.2 Owner Residence

Less than 3 percent of the BSAI groundfish catch in 2002 was taken by vesels with owners who indiated that they were residents of Alaska (Hiatt et al. 2003). Residents of other states, particularly Washington and Oregon, are active participants in the BSAI groundfish fisheries.

4.5.3 Ports

When the fishing ports are ranked, from highest to lowest, on the basis of their 1997 groundfish landings and value, the first five ports account for in excess of 95 percent of the total Alaska (BSAI and GOA) groundfish landings. These are, in rank order:

Port & Ranking	Metric Tons*	Value	Number of Processors
1. Dutch Harbor/Unalaska	224,000	$59,774,500	6
2. Akutan	<120,000	NA	1
3. Kodiak	84,000	$33,488,800	9
4. Sand Point	<45,000	NA	1
5. King Cove	<25,000	NA	1

* estimated total groundfish landings
NA - data cannot be reported due to confidentiality constraints

The remaining 5% or so of total groundfish landings made to Alaska fishing ports is distributed over more than twenty different locations. Very few common characteristics are shared by all these remaining ports. Like virtually every settlement in Alaska (with the exception of Anchorage), these landing ports are all relatively small communities, varying from year-round resident populations of a few hundred people (St. Paul - population 739) to several thousands. The balance of this section will focus on the five primary groundfish ports. Dutch Harbor/Unalaska and Akutan are located on the Bering Sea side of the Alaska Peninsula/Aleutian Island chain, while Sand Point and King Cove are on the Gulf of Alaska side and Kodiak Island, where the port and City of Kodiak are located, is in the Gulf. Nonetheless, a substantial portion of the groundfish processed in Sand Point and King Cove is harvested in the Bering Sea, as is a somewhat lesser share of that landed in Kodiak. Historically, relatively small amounts of groundfish harvested in the GOA have been delivered for processing in Dutch Harbor/Unalaska and Akutan.

4.5.3.1 Dutch Harbor/Unalaska

Dutch Harbor/Unalaska is located approximately 800 miles southwest of Anchorage and 1,700 miles northwest of Seattle. Unalaska is the 11th largest city in Alaska, with a reported year-round population of 4,283 in 2000. The name Dutch Harbor is often applied to the portion of the City of Unalaska located on Amaknak Island, which is connected to Unalaska Island by a bridge. Dutch Harbor is fully contained within the boundaries of the City of Unalaska, which encompasses 115.8 square miles of land and 98.6 square miles of water (Alaska Department of Community and Regional Affairs 1998).

Unalaska is primarily non-Native, although the community is culturally diverse. Subsistence activities remain important to the Aleut community and many long-time non-Native residents, as well. Salmon, Pacific cod, Dolly Varden, Pacific halibut, sea bass, pollock, and flounders are the most important marine species, according to Alaska Department of Fish and Game reports. Sea urchins, razor and butter clams, cockles, mussels, limpets, chiton, crabs, and shrimps make up the shellfish and invertebrates most commonly harvested by subsistence users. Marine mammals traditionally harvested include sea lions, harbor and fur seals, and porpoises. Local residents also harvested reindeer, ducks, geese, sea gull eggs and other bird eggs in great numbers in previous years (NPFMC 1994).

Dutch Harbor/Unalaska has been called the most prosperous stretch of coastline in Alaska. With 27 miles of ports and harbors, several hundred local businesses, most servicing, supporting, or relying on the seafood industry, this city is the center of the Bering Sea fisheries. Dutch Harbor is not only the top ranked fishing port in terms of landings in Alaska, but has held that distinction for the Nation, as a whole, each year since 1989. In addition, it ranked at or near the top in terms of the ex-vessel value of landings over the same period.

Virtually the entire local economic base in Dutch/Unalaska is fishery-related, including fishing, processing, and fishery support functions (e.g., fuel, supply, repairs and maintenance, transshipment, cold storage, etc.). Indeed, Dutch Harbor/Unalaska is unique among Alaska coastal communities in the degree to which it provides basic support services for a wide range of Bering Sea fisheries (Impact Assessment Incorporated 1998). It has been reported that over 90 percent of the population of this community considers itself directly dependent upon the fishing industry, in one form or another (NPFMC 1994).

Historically, Dutch Harbor/Unalaska was principally dependent upon non-groundfish (primarily king and Tanner crab) landings and processing for the bulk of its economic activity. These non-groundfish species continue to be important components of a diverse processing complex in Dutch Harbor/Unalaska. In 1997, for example, nearly 2 million pounds of salmon, more than 1.7 million pounds of herring, and 34 million pounds of crabs were reportedly processed in this port.

Nonetheless, since the mid-1980s, groundfish has accounted for the vast majority of total landings in Dutch Harbor/Unalaska. Again, utilizing 1997 catch data, over 93.5 percent of total pounds landed and processed in this port were groundfish.

While well over 90 percent of this total tonnage was groundfish, a significantly smaller percentage of the attributable ex-vessel value of the catch is comprised of groundfish. While equivalent processed product values for non-groundfish production are not readily available, Alaska fish ticket data indicate that the ex-vessel value of these species landed in Dutch Harbor/Unalaska was nearly $43 million, in 1997; or about 60 percent of the reported gross product value of the groundfish output. If the value added through processing of these non-groundfish species were fully accounted for, the total would obviously exceed the ex-vessel value of the raw catch.

As suggested, transshipping is an integral component of the local service-based economy of this community, as well. The port serves as a hub for movement of cargo throughout the Pacific Rim. Indeed, the Great Circle shipping route from major U.S. west coast ports to the Pacific Rim passes within 50 miles of Unalaska. The Port of Dutch Harbor is among the busiest ports on the west coast. The port reportedly serves more than 50 domestic and foreign transport ships per month. Seafood products, with an estimated first wholesale value substantially in excess of a billion dollars, cross the port's docks each year and are carried to markets throughout the world.

The facilities and related infrastructure in Dutch Harbor/Unalaska support fishing operations in both the BSAI and GOA management areas. Processors in this port receive and process fish caught in both areas, and the wider community is linked to, and substantially dependent upon serving both the on-shore and at-sea sectors of the groundfish industry.

In a profile of regional fishing communities, published by the Council in 1994, the local economy of Unalaska was characterized in the following way:

> If it weren't for the seafood industry, Unalaska would not be what it is today ... In 1991, local processors handled 600 million lbs. of seafood onshore, and 3 billion lbs. of seafood were processed offshore aboard floating processors that use Dutch Harbor as a land base. Seven shore-based and many floating processors operate within municipal boundaries.

While these figures presumably include both groundfish and non-groundfish species, and current sources identify at least eight shore-based processing facilities, they are indicative of the scope of this community's involvement in, and dependence upon, seafood harvesting and processing.

Detailed data on costs, net earnings, capital investment and debt service for the harvesting, processing, and fisheries support sectors in Dutch Harbor/Unalaska are not available.

While Dutch Harbor has been characterized as one of the world's best natural harbors, it offers few alternative opportunities for economic activity beyond fisheries and fisheries support. Its remote location, limited and specialized infrastructure and transportation facilities, and high cost make attracting non-fishery related industrial and/or commercial investment doubtful (at least in the short-run). Sea floor minerals exploration, including oil drilling, in the region have been discussed. No such development seems likely in the short run, however. Unalaska reportedly also expected nearly 6,000 cruise ship visitors in 1996.

Without the present level of fishing and processing activities, it is probable that many of the current private sector jobs in this groundfish landings port could be lost, or at the very least, would revert to highly seasonal

patterns, with the accompanying implications for community stability observed historically in this and other Alaska seafood processing locations dependent upon transient, seasonal work forces. It is likely, for example, that the number of permanent, year-round residents of Dutch Harbor/Unalaska would decline significantly. This would, in turn, alter the composition and character of the community and place new, and different, demands on local government.

The municipal government of the City of Unalaska is substantially dependent upon the tax revenues which are generated from fishing and support activities. Between the State of Alaska's Fisheries Business Tax and Fishery Resource Landings Tax revenues (both of which are shared on a 50/50 basis with the community of origin), local raw fish sales tax, real property tax (on fishery related property), and permits and fees revenues associated with fishing enterprises, the City of Unalaska derives a substantial portion of its operating, maintenance, and capital improvement budget from fishing, and especially groundfish fishing, related business activities.

The local private business infrastructure which has developed to support the needs and demands of the fishery-based population of Dutch Harbor/Unalaska would very clearly suffer severe economic dislocation, should the number of employees in the local plants and fishing fleets decline in response to substantial TAC reductions. While insufficient cost and investment data exist with which to estimate the magnitude of probable net losses to these private sector businesses, it seems certain that a substantial number would fail. With no apparent economic development alternative available to replace groundfish harvesting and processing in Dutch Harbor/Unalaska (at least in the short run), there would be virtually no market value associated with these stranded assets.

4.5.3.2 Akutan

Akutan is located on Akutan Island in the eastern Aleutian Islands, one of the Krenitzin Islands of the Fox Island group. The community is approximately 35 miles east of Unalaska and 766 air miles southwest of Anchorage. Akutan is surrounded by steep, rugged mountains reaching over 2,000 feet in height. The village sits on a narrow bench of flat, treeless terrain. The small harbor is ice-free year-round, but frequent storms occur in winter and fog in summer. The community is reported to have a population of 414 persons, although the population can swell to well over 1,000 during peak fish processing months.

During the 1990 U.S. Census, 34 total housing units existed and 3 were vacant. 527 jobs were estimated to be in the community. The official unemployment rate at that time was .4 percent, with 7.4 percent of all adults not in the work force. The median household income was $27,813, and 16.6 percent of the residents were living below the poverty level.

Akutan ranks as the second most significant landings port for groundfish on the basis of tons delivered and has been characterized as a unique community in terms of its relationship to these BSAI fisheries. According to a recent social impact assessment, prepared for the Council, while Akutan is the site of one of the largest of the shoreside groundfish processing plants in the region, the community is geographically and socially separate from the plant facility.

Indeed, while the village of Akutan was initially judged to be ineligible to participate in the State of Alaska's CDQ program, based largely upon its being associated with "... a previously developed harvesting and processing capability sufficient to support substantial groundfish participation in the BSAI ...", it was subsequently determined that the community of Akutan was discrete and distinct from the Akutan groundfish processing complex.

As a result, Akutan has a very different relationship to the region's groundfish fisheries than does, for example, Dutch Harbor/Unalaska or Kodiak. While the community of Akutan derives economic benefits from its proximity to the large Trident Seafoods shore plant (and a smaller permanently moored processing vessel, operated by Deep Sea Fisheries, which does only crab), the entities have not been integrated in the way other landings ports and communities on the list have.

As a CDQ community, the community of Akutan enjoys access to the BSAI groundfish resource independently of direct participation in the fishery. The CDQ communities as a group will receive CDQs equal to 7.5% of each BSAI groundfish TAC, except for the fixed gear sablefish, pollock, and squid TACs. The CDQ communities will receive 20% of the fixed gear sablefish and 10% of the pollock TACs for the eastern Bering Sea and the Aleutian Islands subareas. Similarly, the economic benefits the community derives from the local 1% raw fish tax from landings at the nearby plant are dependent on BSAI groundfish TACs and the resulting ex-vessel value of groundfish landings.

Although this conclusion pertains to the community of Akutan, implications for the groundfish landings port of Akutan are quite different. The Trident plant is the principal facility in the Akutan port and, historically, a number of smaller, mobile processing vessels have operated seasonally out of the port of Akutan. Akutan does not have a boat harbor or an airport in the community. Beyond the limited services provided by the plant, no other opportunity exists in Akutan to provide a support base for other major commercial fisheries. Indeed, alternative economic opportunities of any kind are extremely limited.

While crab processing was a major source of income for the Akutan plant during the boom years of the late 1970s and early 1980s, with the economic collapse of this resource base in the early 1980s, groundfish processing became the primary source of economic activity. In 1997, for example, State of Alaska and NMFS catch records indicate that, while landings of herring and crabs were reported for the Akutan plant, more than 98 percent of the total pounds landed were groundfish, and these made up more than 80 percent of the estimated total value.

No data on cost, net revenues, capital investment and debt structure are available with respect to Trident Seafood's Akutan plant complex. It is not possible, therefore, to quantify probable attributable net impacts to plant owners/operators of a potential reductions in groundfish catches, although as noted above, the Akutan facility is almost completely dependent upon pollock and Pacific cod deliveries. While some adjustment to alternative groundfish species might be possible, in response to a sharp decline in pollock and/or Pacific cod TACs, the fact that the plant has not become more involved with other groundfish species during the times of the year in which pollock and Pacific cod are not available suggests that the economic viability of such alternatives is limited and certainly inferior for the plant.

Whereas the 1990 U.S. Census reported the population of Akutan at just under 600 (and the Alaska Department of Community and Regional Affairs CIS data places the figure at 414, in 1997), the local resident population is estimated at 80, with the remaining individuals being regarded as non-resident employees of the plant.

The permanent residents of the village are, reportedly, almost all Aleut. While some are directly involved in the cash economy (e.g., a small boat near-shore commercial fishery), many depend upon subsistence activities or other non-cash economic activities to support themselves and their families. The species important for subsistence users reportedly include: salmon, halibut, Pacific cod, pollock, flounders, Dolly Varden, greenling, sea lions, harbor and fur seals, reindeer, ducks and geese and their eggs, as well as intertidal creatures (e.g., clams, crabs, mussels). Berries and grasses are also collected as part of the subsistence harvest (NPFMC 1994a).

4.5.3.3 Kodiak

The groundfish landings port of Kodiak is located near the eastern tip of Kodiak Island, southeast of the Alaska Peninsula, in the Gulf of Alaska. The City of Kodiak is the sixth largest city in Alaska, with a population of 6,869 (Alaska Department of Community and Regional Affairs 1998). The City of Kodiak is 252 air miles south of Anchorage. The port and community are highly integrated, both geographically and structurally. The port and community are the de facto center of fishing activity for the western and central Gulf of Alaska.

Kodiak is primarily non-Native, and the majority of the Native population are Sugpiaq Eskimos and Aleuts. Filipinos are a large subculture in Kodiak due to their work in the canneries. During the 1990 U.S. Census, 2,177 total housing units existed and 126 were vacant. An estimated 3,644 jobs were in the community. The official unemployment rate at that time was 4.4 percent, with 23 percent of the adult population not in the work force. The median household income was $46,050, and 6.2 percent of residents were living below the poverty level.

Kodiak supports at least nine processing operations which receive groundfish harvested from the GOA and, to a lesser extent, the BSAI management areas, and four more which process exclusively non-groundfish species. The port also supports several hundred commercial fishing vessels, ranging in size from small skiffs to large catcher/processors.

According to data supplied by the City:

> The Port of Kodiak is home port to 770 commercial fishing vessels. Not only is Kodiak the state's largest fishing port, it is also home to some of Alaska's largest trawl, longline, and crab vessels.

Unlike Akutan, or even Dutch Harbor/Unalaska, Kodiak has a more generally diversified seafood processing sector. The port historically was very active in the crab fisheries and, although these fisheries have declined from their peak in the late 1970s and early 1980s, Kodiak continues to support shellfish fisheries, as well as significant harvesting and processing operations for Pacific halibut, herring, groundfish, and salmon.

Kodiak processors, like the other onshore operations profiled in this section, are highly dependent on pollock and Pacific cod landings, with these species accounting for 43 percent and 36 percent of total groundfish deliveries, by weight, respectively. The port does, however, participate in a broader range of groundfish fisheries than any of the other ports cited. Most of this activity centers on the numerous flatfish species which are present in the GOA, but also includes relatively significant rockfish and sablefish fisheries.

In fact, Kodiak often ranks near the top of the list of U.S. fishing ports, on the basis of landed value, and is frequently regarded as being involved in a wider variety of North Pacific fisheries than any other community on the North Pacific coast.

In 1997, for example, the port recorded salmon landings of just under 44 million pounds, with an estimated ex-vessel value of over $12 million. Approximately 4.3 million pounds of Pacific herring were landed in Kodiak with an ex-vessel value of more than $717 thousand. Crab landings exceeded 1.1 million pounds and were valued at ex-vessel at more than $2.7 million.

While comparable product value estimates are not currently available for groundfish and non-groundfish production (i.e., first wholesale value), it may be revealing to note that groundfish landings accounted for 79 percent of the total tons of fish and shellfish landed in this port, in 1997.

In addition to seafood harvesting and processing, the Kodiak economy includes sectors such as transportation (being regarded as the transportation hub for southwest Alaska), federal/state/local government, tourism, and timber. The forest products industry, based upon Sitka spruce, is an important and growing segment of the Kodiak economy.

The community is, also, home to the largest U.S. Coast Guard base in the Nation. Located a few miles outside of the city center-proper, it contributes significantly to the local economic base. The University of Alaska, in conjunction with the National Marine Fisheries Service, operates a state-of-the-art fishery utilization laboratory and fishery industrial technology center in Kodiak, as well.

Kodiak appears to be a much more mature and diversified economy that those of any other of the five primary groundfish landings ports in Alaska.

The absence of detailed cost, net revenue, capital investment and debt structure data for the Kodiak groundfish fishing and processing sectors precludes a quantitative analysis of the probable net economic impacts. Nonetheless, one may draw insights from history, as when in the early-1980s king crab landings declined precipitously and Kodiak suffered a severe community-wide economic decline. It was largely the development of the groundfish fisheries which reinvigorated the local economy.

4.5.3.4 Sand Point and King Cove

These are two independent and geographically separate groundfish ‘landings ports’ (lying approximately 160 miles from one another), but because each has only a single processor and each community is small and remote, they are described jointly in this section.

Alaska CIS data place Sand Point’s 1998 population at 808, while King Cove’s population is listed as 897. Sand Point is located on Humboldt Harbor, Popof Island, 570 air miles from Anchorage. Sand Point is described by the Alaska Department of Community and Regional Affairs as "a mixed Native and non-Native community," with a large transient population of fish processing workers. During the April 1990 U.S. Census, 272 total housing units were in existence and 30 of these were vacant. A total of 438 jobs were estimated to be in the community. The official unemployment rate at that time was 2.9 percent, with 32.1 percent of all adults not in the work force. The median household income was $42,083, and 12.5 percent of the residents were living below the poverty level.

King Cove is located on the Gulf of Alaska side of the Alaska Peninsula, 625 miles southwest of Anchorage. The community is characterized as a mixed non-Native and Aleut village. In the 1990 U.S. Census, 195 total housing units were in existence, with 51 of these vacant. The community had an estimated 276 jobs, with an official unemployment rate of 1.8 percent and 24.0 percent of all adults not in the work force. The median household income was $53,631, and 10 percent of the residents were living below the poverty level.

Sand Point and King Cove, like Akutan, are part of the Aleutians East Borough. Unlike Akutan, however, neither Sand Point nor King Cove qualify as a CDQ community. Indeed, both Sand Point and King Cove have had extensive historical linkages to commercial fishing and fish processing, and currently support resident commercial fleets delivering catch to local plants. These local catches are substantially supplemented by deliveries from large, highly mobile vessels, based outside of the two small Gulf of Alaska communities.

King Cove boasts a deep water harbor which provides moorage for approximately 90 vessels of various sizes, in an ice-free port. Sand Point, with a 25 acre/144 slip boat harbor and marine travel-lift, is home port to what some have called, "the largest fishing fleet in the Aleutian Islands" (NPFMC 1994a).

For decades, the two communities have principally concentrated on their respective area's salmon fisheries. In 1997, for example, Sand Point and King Cove recorded salmon landings of several million pounds, each. State of Alaska data confidentiality requirements preclude reporting actual quantities and value when fewer than four independent operations are included in a category. Sand Point and King Cove each have one processor reporting catch and production data. In addition, King Cove had significant deliveries of Pacific herring and crabs. Recently, each community has actively sought to diversify its fishing and processing capability, with groundfish being key to these diversification plans.

According to a recent report presented to the Council (Impact Assessment Incorporated 1998):

> In terms of employment, 87 percent of Sand Point's workforce is employed full time in the commercial fishery; for King Cove this figure is more than 80 percent (United States Army Corps of Engineers 1997, and 1998). In both cases, fishing employment is followed by local government (borough and local) and then by private businesses. Seafood processing ranks after each of these other employers, meaning that the vast majority of the workforce at the shore plants are not counted as community residents.

By any measure, these two communities are fundamentally dependent upon fishing and fish processing. In recent years, groundfish resources have supplanted salmon, herring, and crabs as the primary target species-group, becoming the basis for much of each community's economic activity and stability.

Few alternatives to commercial fishing and fish processing exist, within the cash-economy, in these communities by which to make a living. However, subsistence harvesting is an important source of food, as well as a social activity, for local residents in both Sand Point and King Cove. Salmon and caribou are reportedly among the most important subsistence species, but crabs, herring, shrimps, clams, sea urchins, halibut and cod are also harvested by subsistence users. It is reported that Native populations in these communities also harvest seals and sea lions for meat and oil (Impact Assessment Incorporated 1998).

Any action that significantly diminishes the harvest of GOA and BSAI groundfish resources (especially those of pollock and Pacific cod) would be expected to adversely impact these two communities. King Cove is somewhat unique among the five key groundfish ports insofar as it is relatively more dependent upon Pacific cod than pollock, among the groundfish species landed (69 percent and 31 percent, respectively). Sand Point follows the more typical pattern with 69 percent of its groundfish landings being composed of pollock and 29 percent of Pacific cod (in 1997).

No data on cost, net revenues, capital investment and debt structure are available with respect to the Sand Point or King Cove plant complexes.

4.5.4 Community Development Quota Program Communities

The purpose of the CDQ program was to provide western Alaska fishing communities an opportunity to participate in the BSAI fisheries that had been foreclosed to them because of the high capital investment needed to enter the fishery. The program was intended to help western Alaska communities to diversify their local economies and to provide new opportunities for stable, long-term employment. The original Council

guidance for implementing the CDQ Program focused on using the allocations to develop a self-sustaining fisheries economy.

Although the program was initially proposed for the fixed gear sablefish fishery, it was first implemented for BSAI pollock. The program set aside 7.5 percent of the annual BSAI pollock TAC for allocation to qualifying rural Alaskan communities. The first pollock allocations were proposed for 1992 through 1995, however, the Sustainable Fisheries Act, which amended the Magnuson-Stevens Act, institutionalized the program as part of the BSAI FMP in 1996. CDQ allocations for BSAI sablefish and halibut were added in 1995, and the multi-species groundfish CDQ Program was implemented in late 1998. Ultimately, the program allocates CDQ for pollock, all remaining groundfish species (7.5%, except 20% for fixed gear sablefish), crab (7.5%), and halibut (20% - 100%), as well as a pro-rata share of prohibited species. In 1999, the American Fisheries Act increased the pollock allocation to 10%.

The purpose of the CDQ program is, essentially, to allow a portion of the economic and social benefits derived from the rich fishery resources of the BSAI management areas to accrue to coastal communities in western Alaska that had not been able to capitalize on their proximity to these commercial fisheries. The CDQ region is historically an area with few economic alternatives. By providing CDQ shares to qualifying communities, these communities are able to invest in capital infrastructure, community development projects, training and education of local residents, and develop regionally based commercial fishing or related businesses.

The eligibility criteria for the CDQ communities is established in the Magnuson-Stevens Act. The CDQ communities are comprised of predominantly Alaska Native residents. They are remote, isolated settlements with few natural assets with which to develop and sustain a viable diversified economic base. As a result, unemployment rates are chronically high, which impedes community instability.

While these communities effectively border some of the richest fishing grounds in the world, they have not been able, for the most part, to exploit their advantageous proximity. The full Americanization of these highly valued offshore fisheries has taken place relatively quickly (i.e., the last participation by foreign fishing vessels ended in the Bering Sea in 1990). But the scale of these fisheries (e.g., 2 million mt groundfish TAC), the severe physical conditions within which the fisheries are prosecuted, and the very high capital investment required to compete in the open-access management environment, all contributed to effectively precluding these villages from participating in this development. The CDQ program serves to extend an opportunity to qualifying communities to directly benefit from the exploitation of these local resources.

The communities that are currently eligible to participate in the CDQ program include 65 coastal Alaska villages, with a combined population estimated at roughly 274,000. The CDQ-qualifying communities have organized themselves into six non-profit groups (with between 1 and 20 villages in each group). The CDQ-villages are geographically dispersed, extending from Atka, on the Aleutian chain, along the Bering Sea coast, to the village of Wales, near the Arctic Circle. The current CDQ groups are listed below.

> Aleutian Pribilof Island Community Development Association (APICDA): The communities represented by APICDA are relatively small and located adjacent to the fishing grounds. Population of the six communities is approximately 1,140.
>
> Bristol Bay Economic Development Corporation (BBEDC): BBEDC represents villages distributed around the circumference of Bristol Bay, including Dillingham, the second-largest CDQ community

with approximately 2,470 residents and the location of BBEDC's home office. Total population is approximately 5,930.

Central Bering Sea Fisherman's Association (CBSFA): CBSFA is unusual among CDQ groups in that it represents a single community, St. Paul in the Pribilof Islands, with a population of 530.

Coastal Villages Region Fund (CVRF): CVRF manages the CDQ harvest for its member villages. The villages are located along the coast between the southern end of Kuskokwim Bay and Scammon Bay, including Nunivak Island.

Norton Sound Economic Development Corporation (NSEDC): Approximately 8,500 people make up the region represented by NSEDC, which ranges from St. Michael to Diomede.

Yukon Delta Fisheries Development Association (YDFDA): YDFDA represents the communities, Alakanuk, Emmonak, Grayling, Kotlik, Mountain Village, and Sheldon Point, containing approximately 3,120 people.

One of the criteria for community eligibility in the CDQ Program is that the community could not have previously developed harvesting or processing capability sufficient to support substantial groundfish fisheries participation in the BSAI (unless the community could show that benefits from CDQ allocations would be the only way to realize a return on previous investments). Therefore, to derive economic benefit from their respective allocations, it has been necessary (with the exception of some of the halibut and sablefish CDQs) for each CDQ group to enter into a relationship with one or more of the commercial fishing companies which participate in the fisheries. In this way, the CDQ community brings to the relationship preferential access to the fish and the partnering firm brings the harvesting/processing capacity. The nature of these relationships differs from group to group, but all of the groups are part owners in one or more fishing vessels and companies. In every case, the CDQ community receives royalty payments on apportioned catch shares. Some of the agreements also provide for training and employment of CDQ-community members within the partners' fishing operations, as well as other community development benefits.

4.6 Ecosystem Characteristics

Ecosystem characteristics of the Bering Sea and Aleutian Islands are assessed annually in the *Ecosystem Considerations* appendix to the *Bering Sea and Aleutian Islands and Gulf of Alaska Stock Assessment and Fishery Evaluation* report. Since 1995, this document has been prepared in order to provide information about the effects of fishing from an ecosystem perspective, and the effects of environmental change on fish stocks. Since 1999, the section has included information on indicators of ecosystem status and trends, and more ecosystem-based management performance measures.

Since 2003, an annual Ecosystem Assessment has also been included in the appendix to the SAFE. The primary intent of the assessment is to summarize historical climate and fishing effects of the shelf and slope regions of the eastern Bering Sea and Aleutian Islands, and Gulf of Alaska, from an ecosystem perspective and to provide an assessment of the possible future effects of climate and fishing on ecosystem structure and function. The *Ecosystem Considerations* sections from 2000 to the present are available online at www.afsc.noaa.gov/refm/reem/Assess/Default.htm or by request from the Council office.

4.6.1 Ecosystem Trends in the Bering Sea and Aleutian Islands Management Area

This section is drawn from the *Final Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries* (NMFS 2004), available on the NMFS Alaska Region website (www.fakr.noaa.gov), or by request from the NMFS Alaska Region office.

In a review of fishery trends and potential fishery-related impacts within the BSAI ecosystem, Livingston *et al.* (1999) examined historical biomass trends of three different trophic guilds to see if there was a relationship between fishing or climate and changes in total guild biomass or changes in species composition within guilds. For example, large fishing removals of one guild species might result in increases in other members of that guild as competitive pressures ease. Similarly, if fishing removes large numbers of a prey species important to all members of the guild, an overall decrease in the abundance of all the guild species might be observed, as well as decreased mean size at age of predators relying on that prey. Alternatively, if the factor inducing the observed change is environmental, trends in abundance or in mean size at age that correlate positively or negatively with temperature or other physical oceanographic factors might be seen. Three trophic guilds were examined:

1. offshore fish, mammals, and seabirds that consume small pelagic fish;
2. inshore fish, crabs, and other benthic epifauna that primarily consume infauna; and
3. a ubiquitous group that feeds on crab and fish (Figure 4-5).

Despite conservative exploitation rates, a variety of species in diverse trophic groups (e.g., arrowtooth flounder, Greenland turbot, some seabirds, and marine mammals) showed either increasing or decreasing long-term trends in abundance, and both fished and unfished species (pollock, cod, crabs, sea stars, and others) showed cyclic fluctuations in abundance over the two decades from 1979 to 1999. No link was found between species declines and prey abundance. The timing of some species declines, e.g., marine birds, was actually correlated with increases in the adult populations of their main prey species–in this case, pollock. Similarly, the timing of increases in some guild member biomass values did not relate to fishing intensity on other guild members (e.g., skate versus cod). The Livingston *et al.* study, however, did not consider spatial changes in prey abundance or availability that could occur, and these factors cannot be ruled out as potential causal links to changes in predator abundance.

Physical oceanographic factors, particularly northward or southward shifts in regional climatic regimes, were correlated with the recruitment of some guild members (see Section 4.6.2), and decreases in individual growth of some species (rock sole) were linked to increases in rock sole biomass. Diversity changes in some trophic guilds were related to increases in a dominant guild member (e.g., pollock in the pelagic fish consumer guild, and rock sole in the benthic infauna consumer guild) rather than to fishing-induced changes in diversity.

The study by Livingston *et al.* (1999) showed a stable trophic level of catch and stable populations overall. The trophic level of the Bering Sea harvest has risen slightly since the early 1950s and appears to have stabilized as of 1994.

<u>Modeling Biological Interactions Among Multiple Species</u>

Livingston and Jurado-Molina (1999) have developed a computer-based model of predator-prey interactions among the dominant groundfish species in the EBS. Three goals have directed the development of this multi-species model: 1) to examine trends in mortality due to predation, 2) to examine the relative importance of

predation versus climate in influencing fish recruitment, and 3) to provide a basis for evaluating how future changes in fishing intensity might affect the groundfish community. The model uses information on historical catch estimates and predation among the species to estimate numbers at age and predation mortality of groundfish populations. The following species are modeled as predators: walleye pollock, Pacific cod, Greenland turbot, yellowfin sole, arrowtooth flounder, and northern fur seal. Arrowtooth flounder and northern fur seal are considered "other predators," which means that population and mortality estimates are not made directly for these species. However, it is feasible to estimate the impact of their predation on other species in the model. Prey species are walleye pollock, Pacific cod, Greenland turbot, yellowfin sole, rock sole, and Pacific herring.

Results from the modeling indicate that most predation mortality occurs on juveniles, particularly juvenile walleye pollock. This juvenile mortality varies over time, and recruitment of juveniles into the adult population also varies. Cannibalism by adult pollock explains some of the recruitment variation, but it appears that much of the variability is related to climatic variation (see Section 4.6.2). Understanding of predation and climate as structuring forces on groundfish communities will be advanced when multi-species predation models like these are linked to climate models that predict survival rates of larval fish before they are vulnerable to predation.

Output from this predation model can be used to evaluate the multi-species implications of various fishing strategies. One question asked about the BSAI by groundfish stock assessment biologists is: What effects might uneven groundfish harvesting rates have on groundfish community dynamics? For example, some species, such as pollock, are fished up to the recommended level of ABC, while others, such as rock sole and yellowfin sole, are fished at levels below ABC for economic and bycatch reasons. Using a multi-species model, Jurado-Molina and Livingston (2000) examined what could happen over the long-term future to groundfish population size if species were harvested more evenly or were not harvested at all. They compared these projected changes with model predictions based on current groundfish fishing rates. They also compared the results with predictions using single-species models that did not consider predation interactions.

In the scenario where groundfish were fished more evenly (F_{ABC}) than actually occurs under the present harvesting regime (F_{REF}), the single-species models predicted almost the same population changes that the multi-species model did. The biggest differences between multi-species and single-species models were seen in the predictions for prey species biomasses of herring and rock sole, but even these were not very large (Figure 4-6).

Small differences in the predictions are the result of evaluating relatively small changes in fishing intensity. Larger differences between single-species models and the multi-species model are seen when the present fishing strategy (F_{REF}) is compared with a no-fishing strategy (Figure 4-7). Here, the main reason for the difference is that the multi-species model predicts that predators increase their consumption of prey when there is no fishing. The model results indicate that when pollock fishing is stopped, the largest beneficiary species is pollock itself. This is because adult pollock consume mostly younger (age 0 and age 1) pollock, while other predators tend to consume mostly older (age 1 and older) pollock. In the long-term, consumers of small pollock get the first opportunity to benefit from the increased abundance of juveniles when fishing stops.

In summary, the results of multi-species predator-prey modeling suggest that implementation of a more even harvesting regime would not produce effects much different from changes predicted by single-species models. The largest difference occurs in predictions under a no-fishing scenario, with the multi-species model predicting smaller increases in prey species such as pollock, rock sole, and herring than those

predicted by the single-species models. Increases in predator populations, and thus predation mortality, under a no-fishing scenario are the reason for the lower rate of increase in prey populations in the multi-species model.

Multi-species Technological Interactions

Harvesting can have multi-species implications through technological interactions (i.e., co-occurrence of multiple species in a single target species fishery). When specific fisheries are unable to catch their target species exclusively, their fishing effort imposes some mortality on each species that is taken as bycatch. Bycatch of non-target flatfish species is a particularly important characteristic of several EBS target fisheries, including yellowfin sole, rock sole, flathead sole, and Alaska plaice. These species, along with Pacific halibut, occupy similar habitats on the EBS shelf and co-occur to varying degrees in the harvest. Additionally, the retention of Pacific halibut is prohibited in the federally managed groundfish fishery, and quotas of halibut bycatch—not directed target quotas—have been the main factor in restricting the fishery in recent years.

The total trawling effort for all flatfish fisheries combined imposes a variety of fishing mortality rates on the individual flatfish species. This has been evaluated with a multi-species yield-per-recruit model (Spencer *et al.* 1999). One motivation for such modeling is to consider management options that would increase the total flatfish yield, factoring in the bycatch of flatfish in the various fisheries. A main feature of this model is that a catchability coefficient is computed for each species and fishery, based on recent catch and effort data; the distribution of effort among the various EBS trawl fisheries (defined by species catch composition) is based on the same data. The slope of each line in Figure 4-8 is the total catchability for a particular species, resulting from all fisheries that harvest the species. For example, the catchability of yellowfin sole is higher than other species because a significant proportion of total trawling effort is directed toward this fishery, and this species has relatively high catchabilities in several fisheries.

Reaching halibut bycatch quotas early has resulted in early closures of the flatfish fisheries, thus resulting in large differences between fishing levels that would attain the ABC at F_{ABC} (triangles in Figure 4-8) and recent average F levels (asterisks) for most fisheries. One way to manage these species that are caught together would be to derive biological reference points for the complex as a whole. The $F_{40\%}$ level for the group combined (squares in Figure 4-8) would produce higher yields (in the absence of halibut bycatch quotas) than the single-species approach. This approach for managing flatfish as a group, however, would expose the yellowfin sole population to a higher fishing rate than the rate that would be recommended in a single-species management scheme. Therefore, this strategy might not provide optimal protection for yellowfin sole. If the complex were managed to protect the weakest stock (yellowfin sole), the combined flatfish fisheries would be able to increase effort by only a relatively small amount above the current effort levels (to the level of effort that would reach the yellowfin sole ABC at F_{ABC} (triangle in Figure 4-8). There is a relatively small difference between the recent average yellowfin sole F and the yellowfin sole $F_{40\%}$, indicating that there would be no significant change from current practice.

The limitation currently imposed on flatfish fisheries by the halibut bycatch quota has motivated fishermen to develop methods of reducing trawling effort that has high catchability on halibut (Gauvin *et al.* 1995) and also to develop fishing gear with lower halibut catchability (i.e., halibut excluder devices). These gear improvements and the already mandated phasing-in of requirements for retaining flatfish bycatch under the improved retention/improved utilization management approach show promise for producing a fishery management system with increased protection for protected species such as halibut and a large reduction in the levels of flatfish discards in flatfish fisheries. Because the gear improvements and improved retention scheme implementation will change the nature of the effort and multi-species catch characteristics of these

target fisheries, the impacts of the improvements must be evaluated before multi-species biological reference points can be developed for target flatfish.

Figure 4-5 Biomass trends in Bering Sea trophic guilds, 1979-1998.

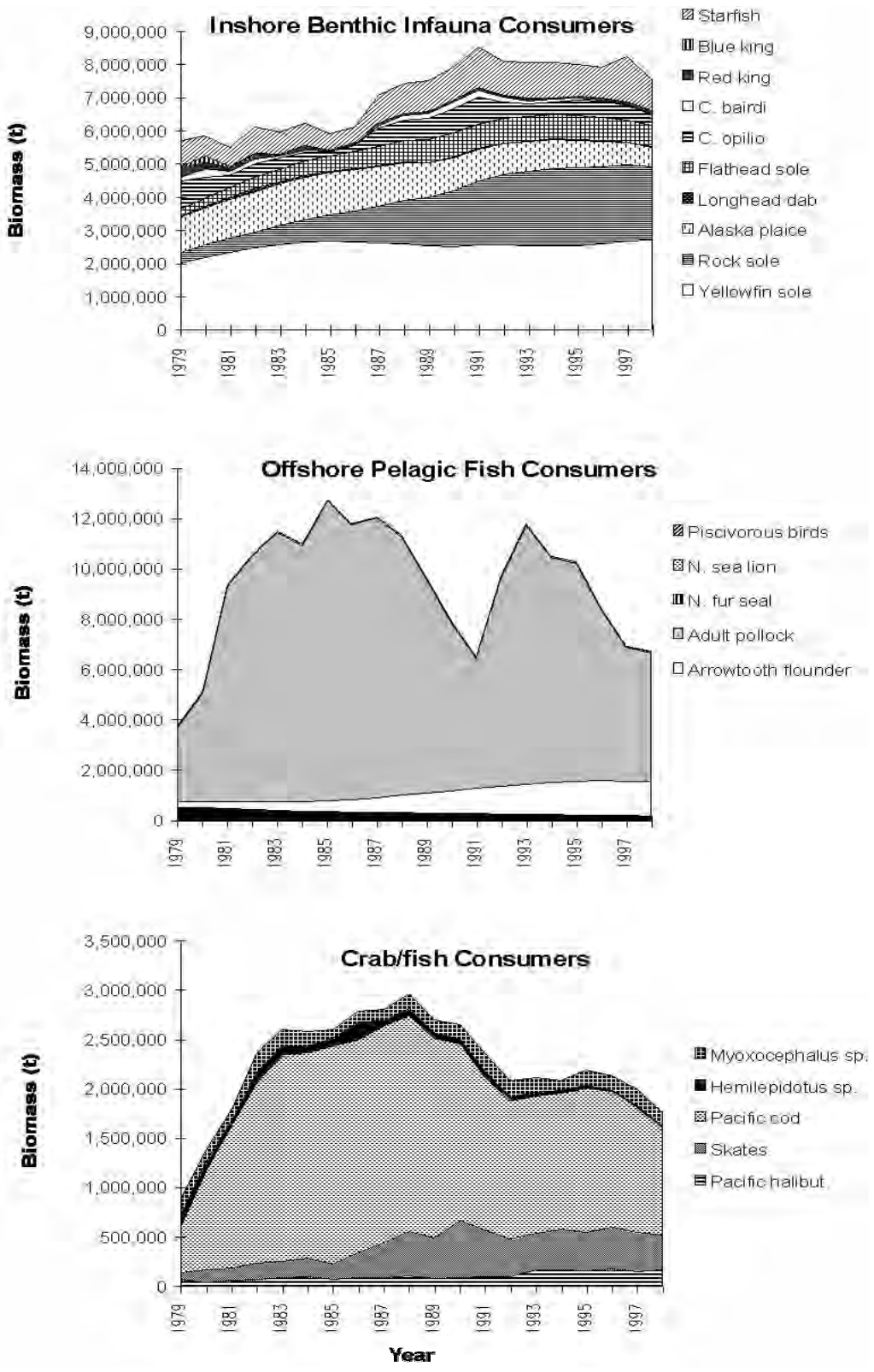


Figure 4-6 Results from the multispecies and single-species models for change in equilibrium biomass between the present fishing rates (F_{ref}) and more even harvesting of all species (F_{abc}). Note: plk = pollock, cod = Pacific cod, gtb = greenland turbot, yfs = yellowfin sole, rsol = rock sole, her = herring, SSB = steady state biomass.

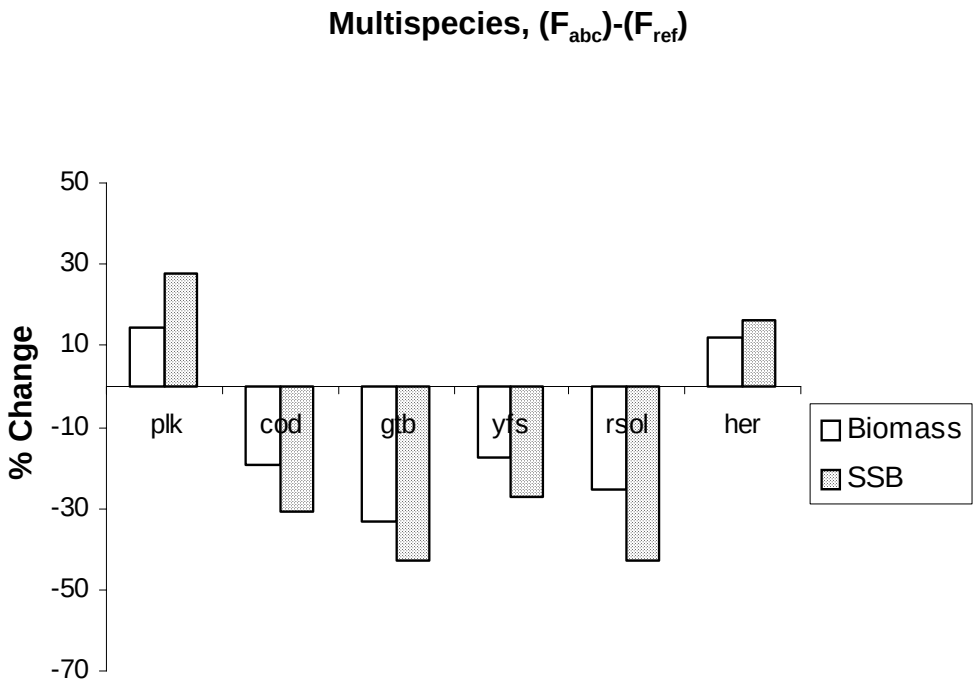


Figure 4-7 Percent change in single-species and multispecies model predictions of biomass between the present fishing strategy (F_{ref}) and a no-fishing (F=0) scenario. Note: plk = pollock, cod = Pacific cod, gtb = greenland turbot, yfs = yellowfin sole, rsol = rock sole, her = herring, SSB = steady state biomass.

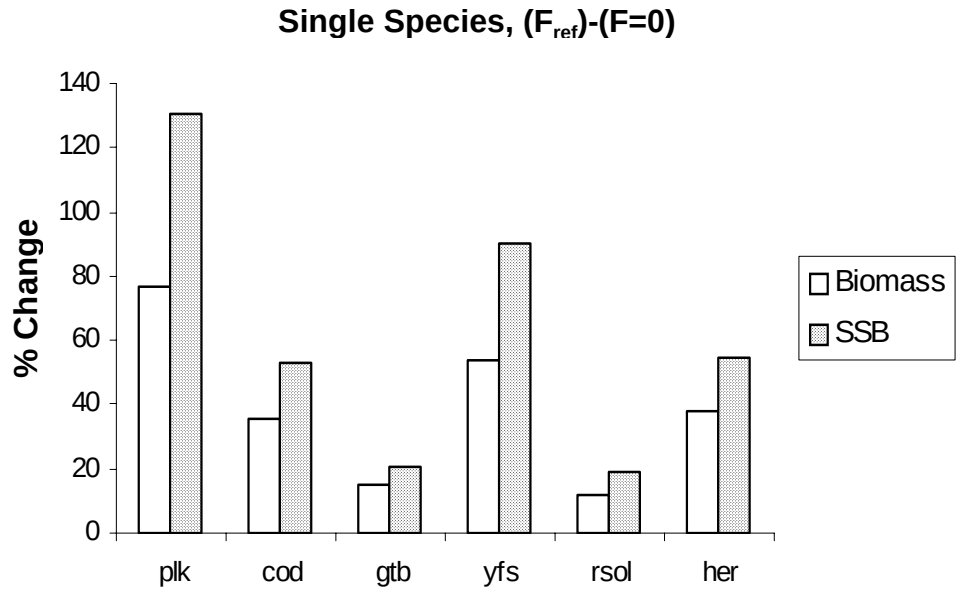
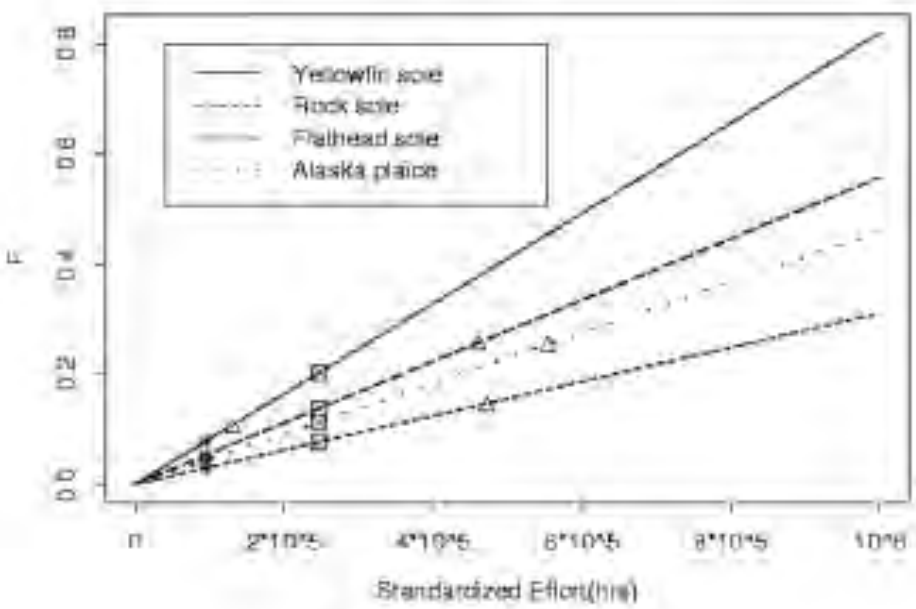


Figure 4-8 Eastern Bering Sea flatfish instantaneous fishing mortality rates as a function of total standardized trawling effort. Results were obtained from a multispecies yield per recruit model, and each species incorporates the contribution of all eastern Bering Sea trawl fisheries. Triangles indicate the $F_{40\%}$ single-species reference points, asterisks indicate the recent average *F*s and total trawl standardized effort, and squares indicate the $F_{40\%}$ multi-species reference point for the flatfish complex as a whole. Source: NMFS.



4.6.2 Climate-Implicated Change

This section is drawn from the *Final Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries* (NMFS 2004), available on the NMFS Alaska Region website (www.fakr.noaa.gov), or by request from the NMFS Alaska Region office.

Evidence from observations during the past two decades and the results of modeling studies using historical and recent data from the North Pacific Ocean suggest that physical oceanographic processes, particularly climatic regime shifts, might be driving ecosystem-level changes that have been observed in the BSAI and GOA. Commercial fishing has not been largely implicated in BSAI and GOA ecosystem changes, but studies of other ecosystems with much larger fishing pressures indicate that fishing, in combination with climate change, can alter ecosystem species composition and productivity (Jennings and Kaiser 1998, Livingston and Tjelmeland 2000).

During 1997 and 1998, a period of warmer-than-usual ambient air temperatures (Hare and Mantua 2000), a number of unusual species occurrences were observed in the BSAI and GOA, including the following examples:

- In 1998, several warm-water fish species, including Pacific barracuda (*Sphyraena argentea*), were observed and/or caught in the GOA. Ocean sunfish (*Mola mola*) and chub mackerel (*Scomber japonicus*), occasionally recorded in southeast Alaskan waters, were documented there in unusually large numbers. Similarly, Pacific sleeper sharks (*Somniosus pacificus*) were caught (and released) in higher than normal levels in Cook Inlet, and salmon sharks (*Lamna ditropis*) were taken in fairly large numbers off Afognak Island (Kevin Brennan, ADF&G, personal communication).

- Spiny dogfish (*Squalus acanthias*) substantially increased in the Kodiak area and in Prince William Sound (Bill Bechtol and Dave Jackson, ADF&G, personal communication). In 1998, this species' inclusion in collection tows increased by more than 40 percent. A corresponding increase in spiny dogfish has been observed in the International Pacific Halibut Commission's GOA halibut longline bycatch surveys (Lee Hulbert, NMFS, personal communication).

- Individuals of several marine mammal species were seen at unusual times and/or places during 1998, including a Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) near Haines and a northern right whale (*Eubalaena glacialis*) off Kodiak Island.

- Unusual bird sightings in the GOA included a gray-tailed tattler (*Heteroscelus brevipes*) south of the Kenai Peninsula and a mallard (*Anas platyrhynchos*) several miles offshore in the open ocean. Common murre (*Uria aalge*) die-offs were reported in Cook Inlet, Kodiak, the eastern Aleutians, Resurrection Bay, and the Eastern Bering Sea.

- Three northern elephant seals (*Mirounga angustirostris)* were spotted in nearshore waters around Unalaska during late June and early July, whereas they are usually found farther offshore and at a different time of year.

- There were poor returns of chinook (*Oncorhynchus tshawytscha*) and sockeye (*Oncorhynchus nerka*) salmon to Bristol Bay during both years.

Research on climate shifts as a forcing agent on species and community structure of the North Pacific Ocean can be found in Francis and Hare (1994), Klyashtorin (1998), McGowan *et al.* (1998), Hollowed *et al.* (1998), and Hare and Mantua (2000). The approach used in these studies assesses correlations between past climatic patterns and changes in biomass or recruitment rate for particular marine species. Because cause-and-effect relationships between temporal and spatial patterns of climate change and corresponding patterns of change in biological populations have not been proven for the BSAI and GOA, the correlations must be considered circumstantial. But there are reasons to expect that causal links do exist. For example, stronger recruitment would be expected under more favorable climatic conditions, because more juveniles would be likely to survive to adulthood, whereas harsh conditions would result in weak recruitment because fewer juveniles would survive. In both cases, the recruitment patterns would be reflected in the strength or weakness of the affected age groups within future fisheries.

Francis and Hare (1994) analyzed historical data supporting a climate shift that caused a precipitous decline in the sardine (*Sardinops sagax*) population off Monterey, California in the 1950s. Although it had been widely concluded that this decline resulted solely from overfishing, the data indicate instead that a change in sea surface temperature was closely correlated with the sardines' disappearance, and this related closely to patterns of sardine numbers in marine sediments off Southern California. Consequently, both climate and fishing are now recognized to be implicated in the sardine population decline.

Francis and Hare (1994) related the intensity of the Aleutian low pressure system (Aleutian low), a weather pattern, with production of salmon and zooplankton. Winter ambient air temperatures at Kodiak and the North Pacific Index, an index tracking the intensity of the Aleutian low during the winter, were used as indicators of climatic severity. Strong correlations were found between long-term climatic trends and Alaskan salmon production. Annual weather patterns were found to be closely correlated with changes in zooplankton populations.

For the northeastern North Pacific Ocean, McGowan *et al.* (1998) showed that interannual climatic variations linked to the ENSO and decadal-scale climate shifts can be detected in physical oceanographic data. For instance, the depth of the mixed layer in the California Current and GOA became shallower over time, whereas the mixed-layer depth in the Central Pacific deepened during the same period. This was not, however, reflected in the mass flow of the California Current. Greater depth of the mixed layer during elevated sea surface temperature events was correlated with decreased nutrient availability, plankton abundance, and shifts in community structure. These researchers concluded that climatic events such as ENSO are correlated with changes in biological populations associated with the California Current. Biological processes in the GOA appear to be more strongly influenced by variations in the Aleutian low.

According to McGowan *et al.* (1998), climate-related changes in the biological communities of the California Current system ranged from declines in kelp forests to shifts in the total abundance and dominance of various zooplankton species. Some fish and invertebrate populations declined, and the distributional ranges of species shifted northward. In addition, seabird and marine mammal reproduction were apparently affected by ENSO conditions. Interdecadal changes in community structure also occurred, with intertidal communities becoming dominated by northward-moving southern species and changes in species proportions occurring in most other sectors of the ecosystem.

Interdecadal shifts observed in the northeastern North Pacific Ocean ecosystem have been of the opposite sign from those in the California Current system, with increases in zooplankton biomass and salmon landings observed in the GOA (McGowan *et al.* 1998, Francis and Hare 1994). These shifts have corresponded to the intensity and location of the winter mean Aleutian low, which changes on an interdecadal time scale.

Klyashtorin (1998) linked catch dynamics of Japanese sardines, California sardines, Peruvian sardines, Pacific salmon, Alaska pollock, and Chilean jack mackerel in the Pacific with an atmospheric circulation index that shows trends similar to the North Pacific Index used by other researchers. Other species, such as Pacific herring and Peruvian anchovy, are negatively associated with this index.

Hollowed *et al.* (1998) analyzed oceanographic and climatic data from the eastern North Pacific Ocean and compared those data with information on recruitment for 23 species of groundfish and five non-salmonid species and with catch data for salmon. The fish recruitment data were compared to environmental factors over various time scales and with varying time lags. Hollowed *et al.* (1998) found that, for species such as pollock, cod, and hake, recruitment was generally stronger during ENSO events. Whereas salmon and large-mouthed flatfish such as arrowtooth flounder, Greenland turbot, and Pacific halibut responded more strongly to longer-term events such as decadal-scale climatic regime shifts. Because both ENSO and decadal-scale ecosystem shifts are environmentally controlled, the results of this analysis support climate change as an important controlling factor in ecosystem dynamics.

There is considerable evidence that decadal and basin-scale climatic variability (Section 3.3.4) can affect fish production and ecosystem dynamics. Sudden basin-wide shifts in climatic regime have been observed in the North Pacific Ocean (Mantua *et al.* 1997), apparently due to changes in atmospheric forcing. Eastward- and northward-propagating storm systems dominate the wind stress on surface waters for short periods (less than

one month), mixing the upper layers and altering sea surface temperatures (Bond *et al.* 1994). Because fish are very sensitive to ambient water temperature, even changes in surface temperature, if sufficiently frequent or prolonged, can alter fish distribution and reproductive success as well as recruitment (the number of juveniles that survive to enter the adult, reproducing portion of the population).

In a long-term trends analysis by computer, Ingraham and Ebbesmeyer (Ingraham *et al.* 1998) used the OSCURS model to simulate wind-driven surface drift trajectories initiated during winter months (December through February) for the period 1946 to present. The model-generated endpoints of the 3-month drift trajectories shifted in a bimodal pattern to the north and south around the mean. The winter flow during each year was persistent enough to result in a large displacement of surface mixed-layer water. The displacement also varied in a decadal pattern. Using the rule that the present mode is maintained until three concurrent years of the opposite mode occur, four alternating large-scale movements in surface waters were suggested: a southward mode from 1946 to 1956, a northward mode from 1957 to 1963, a southward mode from 1964 to 1974, and a northward mode from 1975 to 1994. As more northern surface water shifts southward, colder conditions prevail farther south, and as southward water moves northward, warmer conditions prevail farther north, both potentially affecting fish distribution and population dynamics.

Real-world evidence that atmospheric forcing alters sea surface temperatures comes from two principal sources: shorter-term ENSO events and longer-term Pacific Decadal Oscillations (Mantua *et al.* 1997). Temperature anomalies in the BSAI and GOA indicate a relatively warm period in the late 1950s, followed by cooling especially in the early 1970s, followed by a rapid temperature increase in the latter part of that decade. Since 1983, the BSAI and GOA have undergone different temperature changes. Sea surface temperatures in the BSAI have been below normal, whereas those in the GOA have been generally above normal. Consequently, the temperature difference between the two bodies of water has jumped from about 1.1°C to about 1.9°C (U.S. GLOBEC 1996).

Subsurface temperatures, potentially an even more important influence on biological processes, have been documented to change in response to climatic drivers. There was a warming trend in subsurface temperatures in the coastal GOA from the early 1970s into the 1980s similar to that observed in GOA sea surface waters (U.S. GLOBEC 1996).

In addition, seawater temperature changes in response to ENSO events occurred, especially at depth, in 1977, 1982, 1983, 1987, and in the 1990s. The 1997-1998 ENSO event, one of the strongest recorded in the twentieth century, substantially changed the distribution of fish stocks off California, Oregon, Washington, and Alaska. The longer-term impacts of the 1997-1998 ENSO event remain to be seen. Francis *et al.* (1998) reviewed the documented ecological effects of this most recent regime shift through lower, secondary, and top trophic levels of the North Pacific Ocean marine ecosystem. Some of the following impacts on higher trophic levels are based on this review:

- Parker *et al*. (1995) demonstrated marked similarities between time series of the lunar nodal tidal cycle and recruitment patterns of Pacific halibut.

- Hollowed and Wooster (1995) examined time series of marine fish recruitment and observed that some marine fish stocks exhibited an apparent preference (measured by the probability of strong year and average production of recruits during the period) for a given climate regime.

- Hare and Francis (1995) found a striking similarity between large-scale atmospheric conditions and salmon production in Alaska.

- Quinn and Niebauer (1995) studied the Bering Sea pollock population and found that high recruitment coincided with years of warm ocean conditions (above normal air and bottom temperatures and reduced ice cover). This fit was improved by accounting for density-dependent processes.

Additional evidence of marine ecosystem impacts linked to climatic forcing comes from Piatt and Anderson (1996), who provided evidence of possible changes in prey abundance due to decadal-scale climate shifts. These authors examined relationships between significant declines in marine birds in the northern GOA during the past 20 years and found that statistically significant declines in common murre populations occurred from the mid- to late 1970s into the early 1990s. They also found a substantial alteration in the diet composition of five seabird species collected in the GOA from 1975 to 1978 and from 1988 to 1991, changing from a capelin-dominated diet in the late 1970s to a diet in which capelin was virtually absent in the later period.

The effects of ten-year regime shifts on the inshore GOA were analyzed using data from 1953 to 1997 (Anderson and Piatt 1999). Three taxonomic groups dominated (approximately 90 percent) the biomass of commercial catches during this period: shrimp, cod and pollock, and flatfish. When the Aleutian low was weak, resulting in colder water, shrimp dominated the catches. When the Aleutian low was strong, water temperatures were higher, and biomass the catches were dominated by cod, pollock, and flatfish. Similar results were reported in very nearshore areas of lower Cook Inlet (Robards *et al.* 1999).

Few patterns were seen in the less-common species over the course of the study. Generally, the transitions in dominance lagged behind the shift in water temperature, strengthening the argument that the forcing agent was environmental. However, different species responded to the temperature shift with differing time lags. This was most evident for species at higher trophic levels, which are typically longer-lived and take longer to exhibit the effects of changes. The evidence suggests that the inshore community was reorganized following the 1977 climate regime shift. Although large fisheries for pandalid shrimp may have hastened the decline for some stocks (Orensanz *et al.* 1998), unfished or lightly fished shrimp stocks showed declines. Both Orensanz *et al.* (1998) and Anderson and Piatt (1999) concluded that the large geographic scale of the changes across so many taxa is a strong argument that climate change is responsible.

Other studies have linked production, recruitment, or biomass changes in the BSAI with climatic factors. For example, a climate regime shift that might have occurred around 1990 has been implicated in a large increase in gelatinous zooplankton in the BSAI (Brodeur *et al.* 1999). Recruitment in both crabs and groundfish in the BSAI has been linked to climatic factors (Zheng and Kruse 1998, Rosenkranz *et al.* 1998, Hollowed *et al.* 1998, Hare and Mantua 2000).

There are indications from several studies that the BSAI ecosystem responds to decadal oscillations and atmospheric forcing, and that the 1976-1977 regime shift had pronounced effects. A peak in chlorophyll concentrations in the late 1970s was closely correlated with an increase in summer mixed-layer stability documented at that time (Sugimoto and Tadokoro 1997). Also, on a decadal time scale, chlorophyll concentrations in the summer were positively correlated with winter wind speeds, indicating a positive response of BSAI phytoplankton to stronger Aleutian lows (Sugimoto and Tadokoro 1997).

Evidence of biological responses to decadal-scale climate changes are also found in the coincidence of global fishery expansions or collapses of similar species complexes. Sudden climate shifts in 1923, 1947, and 1976 in the North Pacific Ocean substantially altered marine ecosystems off Japan, Hawaii, Alaska, California, and Peru. Sardine stocks off Japan, California, and Peru exhibited shifts in abundance that appear to be synchronized with shifts in climate (Kawasaki 1991). These historical 60-year cycles are seen in paleo-

oceanographic records of scales of anchovies, sardines, and hake as well. Other examples are salmon stocks in the GOA and the California Current whose cycles are out of phase. When salmon stocks do well in the GOA, they do poorly in the California Current and vice-versa (Hare and Francis 1995, Mantua *et al.* 1997).

In addition to decadal-scale shifts, interannual events such as the ENSO can have significant impacts on fish distribution and survival, and can affect reproduction, recruitment, and other processes in ways that are not yet understood. This is particularly true for higher-latitude regions such as the northern California Current and GOA. As noted above, the 1997-1998 ENSO event significantly changed the distribution of fish stocks off California, Oregon, Washington, and Alaska. A change that has persisted to the present. Predicting the implications of this trend for future fishery management is problematic, in part because ENSO signals propagate from the tropics to high latitudes through the ocean as well as through the atmosphere, and it is difficult to separate these two modes of influence. Information on the dynamics of North Pacific Ocean climate and how this is linked to equatorial ENSO events is not adequate to adjust fisheries predictions for such abrupt, far-reaching, and persistent changes. Warm ocean conditions observed in the California Current during the present regime may be due, in large part, to the increased frequency of ENSO-like conditions.

In conclusion, evidence from past and present observations and modeling studies at the community and ecosystem levels for the BSAI and GOA suggest that climate-driven processes are responsible for a large proportion of the multi-species and ecosystem-level changes that have been documented. Modeling studies have been a valuable tool for elucidating the possible long-term implications of various fishing strategies. As with all computer-based models, these have been sensitive to unproven assumptions about recruitment and its relationship to climate. As the preceding discussion suggests, the models could be improved by incorporating components that include climatic effects on species, particularly with respect to recruitment. However, this approach has not been widely applied yet to species in the BSAI and GOA ecosystems.

4.6.3 Interactions Among Climate, Commercial Fishing, and Ecosystem Characteristics

This section is drawn from the *Final Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries* (NMFS 2004), available on the NMFS Alaska Region weastern Bering Seaite (www.fakr.noaa.gov), or by request from the NMFS Alaska Region office.

Groundfish fishery management in the BSAI and GOA is implemented in a dynamic environment where both commercial fishing and climate-driven physical oceanographic processes interact in complex ways to affect the marine ecosystem. To characterize these interactions, it is necessary to distinguish, where feasible, the separate effects of fishing and climate on biological populations. The following discussion reviews current knowledge regarding these effects and their relationship to ecosystem characteristics.

Three processes underlie the population structure of species in marine ecosystems: competition, predation, and environmental factors. Natural variations in the recruitment, survival, and growth of fish stocks are consequences of these processes. The first process, competition, is a basic concept underlying many ecological theories (e.g., Hairston *et al.* 1960, Welden and Slauson 1986, Yodzis 1978, 1994). It requires an assumption that species in an ecosystem are limited in their access to critical resources such as food, space, reproductive mates, and time for important activities. Predation is important, because it changes prey density, thereby directly or indirectly affecting populations throughout the ecosystem. Finally, environmental factors, particularly climatic processes, are thought to be major agents of change in North Pacific Ocean ecosystems. Climate has the potential to influence the important biological processes of reproduction, growth, consumption and predation, movement, and, ultimately, the survival of marine organisms.

Against this complex and dynamic natural background, human activities such as commercial fishing can influence the structure and function of marine ecosystems. Like competition, predation, and climate change, the effects of commercial fishing can extend over a range of temporal, spatial, and population scales. Large-scale commercial fishing has the potential to influence ecosystems in several ways. It may alter the amount and flow of energy in an ecosystem by removing energy and altering energetic pathways though the return of discards and fish processing offal back into the sea. The recipients, locations, and forms of this returned biomass may differ from those in an unfished system. In addition, the selective removal of species has the potential to change predator-prey relationships and community structures. Fishing gear may alter bottom habitat and damage benthic organisms and communities.

Both climate and commercial fishing activity currently influence the structure and function of the North Pacific Ocean ecosystem (Francis *et al.* 1999). Since climate change and commercial fishing can co-vary, it may be difficult to distinguish the impacts of the two (e.g., Trites *et al.* 1999). The primary way in which complex scientific knowledge is integrated to further the understanding of the influence of natural and human-related processes on marine ecosystems is through the use of models. Models can be as simple as conceptual diagrams that show a picture of how we think a certain ecosystem process operates, or they can be very complicated, with quantitative descriptions of the relationships between various factors and species growth, recruitment, movement, or survival. Reviews of the status of models that have been developed to understand the effects of climate and fishing on ecosystems have been produced by Livingston (1997) and Hollowed *et al.* (2000a). These reviews outline the types of models presently being used and the state of our ability to understand and predict the effects of the two important factors of climate and fishing in marine ecosystems by using models.

Most models that consider more than one species link the species together through knowledge about their feeding (trophic) interactions. Once the trophic linkages among species are understood, questions about impacts of predators and prey on one another (Yodzis 1994), or how natural or human-induced habitat changes affect the food-web structure (Yodzis 1996), can be addressed with a variety of multi-species or ecosystem models. Another model type, called a technical interaction model, may consider the simultaneous capture of groups of species by a particular fishery or type of fishing gear.

With the exception of information on forage fish, which—unlike many marine species—are preyed on as adults and not just mainly as juveniles, most scientific advice from multi-species models is not presently being used in making short-term management decisions. These models are mainly useful for trying to understand the possible medium- (6 to 10 years) and longer-term implications of various management strategies on the ecosystem.

However, long-term predictions from single-species, multi-species, and ecosystem-level models remain uncertain, because the predictions rely heavily on assumptions about recruitment, particularly for predators (Gislason 1991 and 1993), which may be strongly influenced by environmental variation. Limitations still exist regarding the ability to predict both future changes in climate and recruitment rates resulting from a particular climate state.

Therefore, as noted by Parkes (2000) and Hall (1999a), predator-prey models are not considered reliable enough to provide directly applicable management advice at the present time. Hall (1999b) notes that ecosystem-based management advice should move toward setting single-species biological reference points for non-target species, developing single-species reference points for localized regions (i.e., spatially explicit management), and using measures of system-level properties (e.g., species diversity, trophic level of the catch, biomass-size distributions) to derive ecosystem-level reference points.

Food web models of the BSAI, specifically, the Eastern Bering Sea shelf, ecosystem have been developed for the 1950s and 1980s (Trites *et al.* 1999). These models use the Ecopath strategy for evaluating mass-balance in marine ecosystems. Ecopath uses estimates of biomass, consumption, diet, and turnover rates of populations or groups of populations to evaluate energy flow and mass-balance in a particular ecosystem (Christensen 1990).

Ecopath creates static biomass flow models of ecosystems and represents a snapshot of the ecosystem for a given time period. Species in these models are linked, so that the biomass transfer resulting from processes such as fecundity, mortality, production, respiration, and predation are in equilibrium (balanced). These types of models provide a way to identify large-scale views of ecosystems and to highlight data gaps (Christensen 1990, 1992, 1994; Pauly and Christensen 1995).

An examination of energy flow within the ecosystem is instructive, although one must be careful in interpreting the inevitable differences among the flow estimates. For instance, although the magnitude of biomass flow from prey to tertiary consumers (e.g., juvenile pollock to seabird predators) is modest relative to that between primary producers and primary consumers (e.g., phytoplankton to crustaceans), it may nonetheless play a significant role in the dynamics of the food web (P. Yodzis, University of Guelph, Ontario, Canada, personal communication). Further, if a food web is composed of few, highly connected species in a trophic sense, removal of a predator may yield a larger ecosystem perturbation than a similar removal from an ecosystem with weaker trophic links among many predators and prey (e.g., Pimm 1982).

The Ecopath models for the Bering Sea were initially developed to see if impacts of intensive whale harvesting that occurred in the 1950s and 1960s were sufficient to explain the ecosystem structural changes that were observed in the 1980s, discussed in Section 3.10.1.3. The primary removal of energy in both decades was by harvesting whales and pelagic fishes in the 1950s, and pollock in the 1980s. The production estimate for the 1950s simulation showed baleen whales as the dominant ecosystem component. These whales were classed as a midlevel consumer with a trophic level slightly higher than pollock, due to their consumption of squid. The dominant component in the 1980s simulation was pollock, the dominant fishery. There was a slight drop in trophic level of the catch between the two periods, but this was acknowledged to be an artifact of the volume of squid assumed in the diet of the baleen whales. Without this assumption, there was little change in trophic level of harvest. Trophic level of the catch actually incr eased from the 1950s to the 1980s, if only fish harvests are considered. This would suggest that harvesting in the Bering Sea at present is at a level that has been sustained over long periods. A further result of this simulation was that whale harvests required an estimated 47 percent of net primary production in the Bering Sea in the 1950s. Fisheries of the 1980s, dominated by pollock, required only 6.1 percent of primary production.

Measures of ecosystem maturity show some differences between the two Bering Sea models. The ratio of primary production to respiration, net system production, and the ratio of biomass to throughput indicate a more mature ecosystem state in the 1950s compared with the 1980s. This is due to the assumption that benthic infauna biomass was lower in the 1980s. However, benthic infaunal surveys used to estimate biomass for the two models used different methods and may not be comparable.

Trophic pyramids are similar for the two time periods, and both indicate that biomass and energy flow were distributed fairly well throughout the system. The steep-sided shape of the pyramids indicates that there is a lot of energy flow at lower trophic levels. One system maturity index, the ratio of primary production to total biomass, actually indicates a more mature system in the 1980s relative to the 1950s. However, this was due to assumptions about the change in primary production between the two time periods, for which there is conflicting evidence. Conclusions about system maturity will be premature until trends in primary production and benthic infauna biomass are better understood.

The Bering Sea appears to be more mature than other modeled ecosystems, particularly with regard to total system throughput, which measures the sum of all energy flows in the system. It has ecosystem measures that indicate it has significant strength in reserve, which makes it more resilient or resistant to perturbations compared with other ecosystems.

Ecosim, a forward-looking simulation coupled to Ecopath, was used to project the results of various scenarios. The model was run in either an equilibrium or dynamic mode. The equilibrium mode assumed that the total biomass of the ecosystem remained stable, and as the biomass of one component declined, others were required to increase to balance it. Dynamic models do not have this requirement.

The equilibrium mode of Ecosim was used to examine the results of changes in a species' abundance on interacting groups. The results of the equilibrium model suggest that changes in baleen whale numbers could significantly affect pollock populations, and that increases in sperm whale numbers could yield decreases in the numbers of Steller sea lions through competition. Reducing pelagic fish numbers reduces the numbers of seabirds that feed on them, as well as numbers of Steller sea lions and large flatfish. Increasing fishing pressure on pollock would have little effect on their biomass, and increasing fishing pressure on large flatfish would result in increased Steller sea lion populations through the removal of a competitor.

In a different approach, the dynamic mode of Ecosim was used to look at possible mechanisms involved in the historical marine biomass changes seen between the 1950s and the 1980s. Scenarios used for the dynamic model were a regime shift that resulted in changes in primary production; a commercial fishery simulation to see if fishing whale could account for the observed changes; three pollock fishing scenarios that project into the future; and scenarios which varied the fishery mortalities on pollock and pelagic fishes.

These simulations suggested that commercial harvesting of fish and whales had little likelihood of producing the changes seen in actual pollock populations since the 1950s. The effect of increasing primary production provided a much more realistic change in the pollock population. While most groupings showed increases, Steller sea lions did not.

There are substantial uncertainties about the abundance of small pelagic fish in both time periods and the abundance of pollock in the 1950s model. Low abundance of pollock and higher abundance of small pelagic fish in the 1950s was assumed. However, although non-standardized surveys by the Soviets during the 1950s showed apparently lower pollock abundance, their research on diet composition of groundfish indicated that pollock was a primary prey item of many species. It is possible that pollock may have been more abundant in the 1950s than has been assumed. Further model testing with this change in assumptions should be done.

Another dynamic simulation showed that, contrary to what might be expected, stopping the commercial pollock harvest had a slight negative effect on Steller sea lions. This is because two of the Steller sea lion prey items, small pelagic fish and juvenile pollock, declined when adult pollock increased. Adult pollock are cannibalistic and compete with small pelagic fish for large zooplankton prey in this model. More recent versions of the model, which changed the assumptions regarding recruitment now show that juvenile pollock actually increase under this scenario, but that Steller sea lions still show a slight negative effect. This is presumably because of the assumption of the dominance of small pelagic fish as a prey item of Steller sea lions. Small pelagic fish still decline under the assumption of increasing pollock, because adult pollock compete with them for large zooplankton prey.

In conclusion, these model simulations indicate uncertainty about the biomass of lower trophic level species in the two time periods. It appears that climate-related shifts in lower trophic level production could partly explain the ecosystem changes that occurred between the 1950s and the 1980s. However, the model only

captures predation-related recruitment variability and cannot show climate-related variability in recruitment, which is probably much larger. More detailed scenarios that examine the spatial availability of prey will have to be performed to improve our understanding of the complex interaction between fishery removals and predator-prey interactions.

Chapter 5 Relationship to Applicable Law and Other Fisheries

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) is the primary domestic legislation governing management of the U.S. marine fisheries. The relationship of the Fishery Management Plan (FMP) for Groundfish of the Bering Sea and Aleutian Islands (BSAI) Management Area with the Magnuson-Stevens Act and other applicable Federal law is discussed in Section 5.1. The relationship of the FMP to international conventions is addressed in Section 5.2. The relationship of the FMP to other Federal fisheries is addressed in Section 5.3, and to State of Alaska fisheries in Section 5.4.

5.1 Relationship to the Magnuson-Stevens Act and Other Applicable Federal Law

The FMP is consistent with the Magnuson-Stevens Act (16 USC 1851), including the ten National Standards, and other applicable law.

5.2 Relationship to International Conventions

The U.S. is party to many international conventions. Those that directly or indirectly address conservation and management needs of groundfish in the Bering Sea and Aleutian Islands region include:

- Convention for the Preservation of the Halibut Fishery of the North Pacific Ocean and the Bering Sea (basic instrument for the International Pacific Halibut Commission – IPHC)

- Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea (Donut Hole convention)

The Pacific halibut fishery is managed by the International Pacific Halibut Commission. Yet because of the significant interaction between the BSAI groundfish fishery and the halibut fishery, many of the management measures contained herein are for the expressed purpose of mitigating possible adverse effects of the groundfish fisheries on the halibut resource.

<u>International Pacific Halibut Commission (IPHC)</u>

The IPHC was created to conserve, manage, and rebuild the halibut stocks in the Convention Area to those levels which would achieve and maintain the maximum sustainable yield from the fishery. The halibut resource and fishery have been managed by the IPHC since 1923. The IPHC was established by a Convention between the United States and Canada, which has been revised several times to extend the Commission's authority and meet new conditions in the fishery. "Convention waters" are defined as the waters off the west coasts of Canada and the United States, including the southern as well as the western coasts of Alaska, within the respective maritime areas in which either Party exercises exclusive fisheries jurisdiction. Under the

Protocol to the Convention, the Commission retains a research staff and recommends, for the approval of the Parties, regulations regarding: (1) the setting of quotas in the Convention Area, and (2) joint regulation of the halibut fishery in the entire Convention Area under Commission regulations. Neither U.S. nor Canadian halibut fishing vessels are presently allowed to fish in the waters of the other country.

The fishery for Pacific halibut in the BSAI is conducted under an Individual Fishing Quota (IFQ) program, in conjunction with the FMP-managed sablefish resource. A realized benefit of the IFQ program is the reduction in halibut bycatch mortality. Much of the longline bycatch of halibut occurred in sablefish fisheries. To the extent that sablefish fishers have halibut IFQ, this halibut is now retained and counted against target quotas.

As long as Council and IPHC objectives concerning halibut utilization remain similar, 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 fishery development caused by overriding halibut-saving measures – a major social, political, and, perhaps, diplomatic (because of Canadian involvement 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.

Donut Hole Convention

The development, in the mid to late 1980s, of an extensive pollock fishery in the central Bering Sea (donut hole) area of the Aleutian Basin, beyond the U.S. and Russian 200-mile zones, was of great concern to U.S. and Russian fishing interests. The U.S. closed a domestic fishery as a result of the adverse impact this unregulated fishery, which was being prosecuted mostly by distant-water fishing nations, was having on U.S. pollock stocks. Concern also extended to bycatch problems associated with the fishery. The donut hole fishery was being conducted by trawl vessels from Japan, the Republic of Korea, Poland, the People's Republic of China, and the former Soviet Union. Catch data submitted by these countries indicated that annual harvests in the donut area rose to approximately 1.5 million mt in the years leading up to 1989. Largely due to drastic declines in catch and catch-per-unit-effort from 1990, leading to a total catch of under 300,000 mt in 1991 and under 11,000 mt in 1992, the governments involved agreed to a voluntary suspension of fishing in the area for 1993-94. During the 2 year suspension of fishing, an agreed scientific monitoring program was carried out that showed no evidence of the recovery of the resource.

On February 11, 1994, the Parties completed 3 years of negotiations and initialed the Convention on the Conservation and Management of Pollock Resources in the central Bering Sea. Its major principles include: no fishing permitted in the donut hole unless the biomass of the Aleutian Basin stock exceeds a threshold of 1.67 million mt (if the parties cannot agree on an estimate of the biomass, the estimate of the Alaska Fisheries Science Center and its Russian counterpart will be used); allocation procedures; 100 percent observer and satellite transmitter coverage; and prior notification of entry into the donut hole and of transshipment activities. The Convention entered into force in December 1995 (January 1996 for the Republic of Korea).

Despite a moratorium on commercial fishing in the central Bering Sea for the past 10 years, the pollock stocks have not rebuilt. The Aleutian Basin total biomass estimate continues to be low, and trial fishing results continue to show little or no pollock in the central Bering Sea.

5.3 Relationship to Other Federal Fisheries

The North Pacific Fishery Management Council (Council) has implemented four other FMPs in the Alaska exclusive economic zone (EEZ). These FMPs govern groundfish fishing in the Gulf of Alaska (GOA), king and tanner crab fishing in the BSAI, and scallop and salmon fishing in the Alaska EEZ. The relationship of the BSAI groundfish FMP with these other management plans is discussed below.

Gulf of Alaska Groundfish FMP

The BSAI and GOA groundfish fisheries are managed in close connetion with one another. While many of the same groundfish species occur in both the BSAI and GOA management areas, they are generally considered to be separate stocks. There is some overlap between participants in the BSAI and GOA groundfish fisheries. Many of the management measures and stock assessment science are similar for the two areas. Management measures proposed for the BSAI groundfish fisheries are analyzed for potential impacts on GOA fisheries. Where necessary, mitigation measures are adopted (for example, sideboard measures in the AFA pollock cooperative, Section 3.7.2).

BSAI King and Tanner Crab FMP

Domestic fishing for crab for the most part predates the domestic groundfish fishery, and since the inception of the FMP the consideration of crab bycatch in the groundfish fisheries has been paramount. The crab species are considered prohibited in the BSAI groundfish fisheries, with any catch required to be returned immediately to the sea with a minimum of injury, in order to discourage targeting on those species. Other management measures have also been instituted to minimize the bycatch of crab in the groundfish fisheries, including area closures, gear modifications, and catch limits. Some participants in the BSAI crab fishery also target groundfish. The crab FMP contains sideboard measures constraining AFA pollock fishery participants from increasing the participation in the crab fishery.

Scallop FMP

There is very little interaction between the scallop FMP and the BSAI groundfish FMP. Virtually none of the participants in the scallop fishery target groundfish. The scallop FMP contains sideboard measures constraining AFA pollock fishery participants from participating in the scallop fishery.

Salmon FMP

Pacific salmon are also a prohibited species in the BSAI groundfish FMP. There is no fishing of salmon allowed in the EEZ, therefore there is no overlap of participants or grounds conflicts. The BSAI groundfish FMP includes management measures to reduce the bycatch of salmon in federal waters, including catch limits and area closures.

5.4 Relationship to State of Alaska Fisheries

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 the 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".

The relationship of the FMP with State of Alaska fisheries is discussed below.

State parallel groundfish fishery

A parallel groundfish fishery occurs where the State allows the federal species TAC (total allowable catch) to be harvested in State waters. Parallel fisheries occur for pollock, Pacific cod, and rockfish species, for some or all gear types. Opening state waters allows the effective harvesting of fishery resources because many fish stocks straddle State and Federal jurisdiction and in some cases a significant portion of the overall federal TAC is harvested within State waters. Although the State cannot require vessels fishing inside state waters during the Federal fishery to hold a Federal permit, it can adopt regulations similar to those in place for the Federal fishery if those regulations are approved by the Board of Fisheries and meet State statute. An example of a Federal fishery regulation that was concurrently adopted by the Board of Fisheries is the Steller sea lion protection measures implemented in 2001.

State shellfish fishery

King and tanner crab species are considered prohibited in the BSAI groundfish fisheries, with any catch required to be returned immediately to the sea with a minimum of injury, in order to discourage targeting on those species. Other management measures have also been instituted to minimize the bycatch of crab in the groundfish fisheries, including area closures, gear modifications, and catch limits.

State salmon fishery

Pacific salmonids are prohibited species in the BSAI groundfish FMP, and must be immediately returned to the sea with a minimum of injury. Some controversy exists regarding the degree to which salmon bycatch in the groundfish fisheries affects State salmon runs, particularly in times of declining returns. The Council has instituted and reduced salmon bycatch limits in the BSAI groundfish trawl fisheries in response to increased salmon bycatch concerns.

State herring fishery

Pacific herring are considered a prohibited species in the groundfish fishery, and must be immediately returned to the sea with a minimum of injury. Bycatch of herring has historically been high in the Bering Sea pollock fishery, however in the early 1990s the Council adopted a catch limit of 1% of the herring biomass, which has successfully limited bycatch. Bycatch of herring in other target fisheries is very low.

State water subsistence fishery

Subsistence fisheries in Alaska are managed by the State, and take place primarily in state waters. Groundfish fishery participants and fishing communities engage in subsistence activities, however groundfish are a minor target of subsistence fishing (see Section 4.3.3 for a description of the subsistence groundfish fishery). Where appropriate, subsistence groundfish harvests are accounted for in annual groundfish stock assessment.

Chapter 6 References

This chapter contains references for the Fishery Management Plan (FMP) for the Groundfish of the Bering Sea and Aleutian Islands management area (BSAI). Section 6.1 describes the sources of available data regarding the BSAI groundfish fisheries, including annually updated reference material. Section 6.2 provides management and enforcement considerations for the BSAI groundfish fisheries. A list of the literature cited in the FMP is included in Section 6.3.

6.1 Sources of Available Data

Although every effort is made to keep the FMP updated with recent descriptions of the stocks and fisheries, the availability of new data far exceeds the ability of the Council and NMFS to amend the FMP. As a result, in some cases, it may be more expeditious to access the regularly updated reference material directly in order to gain a current picture of the status of the groundfish fisheries. The North Pacific Fishery Management Council (Council) (Section 6.1.1), the National Marine Fisheries Service (NMFS) Alaska Fisheries Science Center (AFSC) (Section 6.1.2), and NMFS Alaska Region office (Section 6.1.3), each produce an abundance of reference material that is useful for understanding the groundfish fisheries. The sections below provide an overview of the types of reports and data available through the various organizations and their websites.

6.1.1 North Pacific Fishery Management Council

6.1.1.1 Stock Assessment and Fishery Evaluation Report

The *Stock Assessment and Fishery Evaluation* (SAFE) report is compiled annually by the BSAI Groundfish Plan team, which is appointed by the Council. The sections are authored by AFSC and State of Alaska scientists. As part of the SAFE report, a volume assessing the *Economic Status of the Groundfish Fisheries off Alaska* is also prepared annually, as well as a volume on *Ecosystem Considerations*.

The report provides information on the historical catch trend, estimates of the maximum sustainable yield 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.

The SAFE report annually updates the biological information base necessary for multispecies management. It also provides readers and reviewers with knowledge of the factual basis for TAC decisions, and illustrates the manner in which new data and analyses are used to obtain individual species groups' estimates of acceptable biological catch and maximum sustainable yield.

Copies of the most recent SAFE report are available online (see below), and by request from the North Pacific Fishery Management Council, 605 W. 4th Avenue, Suite 306, Anchorage, Alaska, 99501.

6.1.1.2 Website

Much of the information produced by the Council can be accessed through its website, to be found at:

http://www.fakr.noaa.gov/npfmc

The information available through the website includes the following.

- FMPs: summaries of the FMPs as well as the FMPs themselves are available on the website
- Meeting agendas and reports: annual quota specifications, amendments to the FMPs or implementing regulations, and other current issues are all discussed at the five annual meetings of the Council. Meeting agendas, including briefing materials where possible, and newsletter summaries of the meeting are available on the website, as well as minutes from the meetings.
- Current issues: the website includes pages for issues that are under consideration by the Council, including amendment analyses where appropriate

6.1.2 NMFS Alaska Fisheries Science Center

Much of the information produced by the AFSC can be accessed through its website, to be found at:

http://www.afsc.noaa.gov/

The information available through the website includes the following.

- Species summaries: a summary of each groundfish species is available online, including AFSC research efforts addressing that species where applicable
- Issue summaries: a summary of major fishery issues is also available, such as bycatch or fishery gear effects on habitat
- Research efforts: a summary of the research efforts for each of the major AFSC divisions is provided on the website
- Observer Program: the homepage describes the history of the program and the sampling manuals that describe, among other things, the list of species identified by observers
- Survey reports: the groundfish stock assessments are based in part on the independent research surveys that are conducted annually, biennially, and triennially in the management areas. Reports of the surveys are made available as NMFS-AFSC NOAA Technical Memorandum , and are available on the website; the data maps and data sets are also accessible.
- Publications: the AFSC Publications Database contains more than 4,000 citations for publications authored by AFSC scientists. Search results provide complete citation details and links to available on-line publications.
- Image library: the website contains an exhaustive library of fish species

6.1.3 NMFS Alaska Region

6.1.3.1 Programmatic SEIS for the Alaska Groundfish Fisheries

Published in 2004, the *Final Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries* (PSEIS) (NMFS 2004) is a programmatic evaluation of the BSAI and GOA groundfish fisheries. The document includes several alternative management policies for the fisheries, and provides the supporting analysis for Amendment 81 to the BSAI FMP, which changed the FMP management policy.

The PSEIS contains a detailed evaluation of the impact of the FMP on groundfish resources, other fish and marine invertebrates, habitat, seabirds, marine mammals, economic and socioeconomic considerations, and the ecosystem as a whole. The impacts are evaluated in comparison to a baseline condition (for most resources this is the condition in 2002) that is comprehensively summarized and includes the consideration of lingering past effects. Additionally, sections of the document describe the fishery management process in place for the Alaska federal fisheries, and the changes in management since the implementation of the FMP in 1982.

6.1.3.2 Website

Much of the information produced by NMFS Alaska region can be accessed through its website, to be found at:

http://www.fakr.noaa.gov/

The information available through the website includes the following.

- Regulations: the FMP's implementing regulations can be found on the Alaska region website, as well as links to the Magnuson-Stevens Act, the American Fisheries Act, the International Pacific Halibut Commission, and other laws or treaties governing Alaska's fisheries
- Catch statistics: inseason and end of year catch statistics for the groundfish fisheries can be found dating back to 1993, or earlier for some fisheries; annual harvest specifications and season opening and closing dates; and reports on share-based fishery programs (such as the individual fishing quota program for fixed-gear sablefish)
- Status of analytical projects: the website includes pages for the many analytical projects that are ongoing in the region
- Habitat protection: maps of essential fish habitat, including a queriable database; status of marine protected areas and habitat protections in Alaska
- Permit information: applications for and information on permits for Alaska fisheries; data on permit holders
- Enforcement: reports, requirements, and guidelines
- News releases: recent information of importance to fishers, fishery managers, and the interested public.

The NMFS Alaska region website also links to the national NMFS website, which covers national issues. For example, NMFS-wide policies, for example on bycatch or improving stock assessments, may be found

on the national website. Also, NMFS produces an annual report to Congress on the status of U.S. fisheries, which can be accessed from this website.

6.2 Management and Enforcement Considerations

This section provides information about management and enforcement of the groundfish fisheries off Alaska. Management and enforcement responsibilities include the following:

- Data collection, research, and analysis to prepare annual stock assessments;
- The annual groundfish specifications process through which TAC limits and prohibited species catch (PSC) limits are established;
- The ongoing process of amending the FMPs and regulations to implement fishery management measures recommended by the Council or NMFS;
- Monitoring of commercial fishing activities to estimate the total catch of each species and to ensure compliance with fishery laws and regulations;
- Actions to close commercial fisheries once catch limits have been reached; and
- Actions taken by NMFS Enforcement, the U.S. Coast Guard (USCG), and NOAA General Counsel to identify, educate, and, in some cases, penalize people who violate the laws and regulations governing the groundfish fisheries.

Management of the groundfish fisheries in the BSAI and enforcement of management measures governing those fisheries comprise a complex system for overseeing fisheries that range geographically over an extensive area of the North Pacific Ocean and Bering Sea.

NMFS manages the fisheries off Alaska based on TAC amounts for target species and PSC amounts for species that may not be retained. The TAC and PSC amounts are further subdivided by gear type, area, and season. As the complexity of the management regime has grown, the number of TAC and PSC subdivisions has grown as well. For example, in 1995 for the BSAI there were 40 TAC allocations, 38 PSC allocations and two CDQ allocations. In 2003 for the BSAI, there were 152 TAC allocations, 78 PSC allocations, and 34 CDQ allocations. Each allocation represents a possible need for NMFS to take management actions, such as closing fisheries, reallocating incidental catch amounts, or investigating overages. When a directed fishery in one area is closed, the boats that participated in the fishery often move to another area or change to another target. This, in turn, often leads to the need for additional management actions.

Though the number of allocations has increased, the quantity of fish available for these allocations has not, and NMFS is required to manage increasingly small blocks of fish. To do this adequately requires the use of increasingly sophisticated catch-monitoring tools, such as observer coverage, electronic reporting, vessel monitoring systems (VMS), and the use of at-sea scales. Though these tools increase the quantity, quality, and timeliness of the data available to NMFS management, they also increase the demands on staff to effectively make use of a larger and more complex data system.

Current fishery management recognizes that a meaningful enforcement program must accompany management measures for them to be effective. As management becomes more complex, the difficulty of adequately enforcing the regulations grows. As the size and complexity of the regulatory environment increases, the burden on enforcement personnel to fully understand the nuances and implications of

regulations increases as well. NMFS/Alaska Region enforcement maintains approximately 36 agents and officers stationed in nine Alaskan ports for monitoring groundfish landings: Juneau, Anchorage, Dutch Harbor, Homer, Ketchikan, Kodiak, Petersburg, Seward, and Sitka. In addition, enforcement personnel regularly travel to other Alaskan ports to monitor landings and conduct investigations. Enforcement personnel associated with NMFS Northwest Region assist in the monitoring of Alaska Region groundfish harvest, primarily individual fishing quota (IFQ) sablefish, landed at ports in the Northwest Region. Also, USCG personnel conduct enforcement activities, monitor vessel activity, conduct at-sea boardings and aircraft overflights, and assist NMFS enforcement personnel in monitoring dockside landings.

A key component of management and enforcement is education and outreach. Complex management programs are accompanied by a regulatory structure that can be difficult for the fishing industry to understand and comply with. This is exacerbated when regulations change rapidly. When fishermen believe that regulations are unduly burdensome or unnecessary, they are less likely to comply voluntarily. Thus, successful implementation of the regulations is dependent on outreach programs that explain the goal of regulations and why they are necessary. NMFS Management, NMFS Enforcement, and the USCG all conduct extensive outreach and education programs that seek not only to explain the regulations, but to help the fishing industry understand the rationale for those regulations.

6.2.1 Expected costs of groundfish management

Estimates of the costs of BSAI and GOA groundfish management are summarized in Table 6-1 below. For reasons discussed in the table, it has not been possible to make accurate estimates of exact expenditures on groundfish management, nor, in some cases, to distinguish between the two groundfish fisheries. An examination of the Table 6-1 suggests that the BSAI and GOA groundfish fisheries appear to cost the U.S. in excess of $60 million, annually, in management and related research efforts. A larger share of this appears to be spent in the BSAI than the GOA.

A comparison of the costs reported in this section with estimates of revenues generated by the groundfish fisheries does not constitute a cost-benefit analysis of this management effort. There are a number of reasons for this:

- The gross revenues from fishing are not a measure of the value of the commercial groundfish fisheries. On one hand, they ignore the private costs (the opportunity costs of labor and capital) used to catch and process the fish resources. On the other hand, they ignore the appropriate measure of benefits to consumers - the “consumers’ surplus” or the value that consumers would be willing to pay for consuming the fish, over and above what they actually have to pay.
- Management costs are only imperfectly identified. Many costs are incurred for multiple purposes, and it is difficult to determine what costs were incurred for which function. Research into ecosystem dynamics may support groundfish management, as well as many other goals. Agency staff often had difficulty determining what portion of an agency budget was spent on groundfish management; staff were often unable to make the even more detailed cost assignment to GOA or BSAI management. This is a problem inherent in the nature of the joint or fixed costs that are often involved. There often simply is no logical way to make these allocations. Even when cost estimates are provided, they are generally very rough approximations.
- The comparison would imply that the management activity was related to the revenues in a specific way. However, specific causal relationships have not been analyzed here. Moreover, even if a causal relationship were implied, it would only be an evaluation of whether or not management at the given level had higher benefits than costs. It would not involve an evaluation

of alternative approaches or levels of management. It would thus be of very limited use for policy decisions.

- The BSAI and GOA groundfish fisheries produce a range of social and ecological services beyond the commercial production and consumption of groundfish products. Groundfish support sport and subsistence fisheries and are an integral part of the North Pacific ecosystem. For example, groundfish provide forage for other fish species, seabirds, and marine mammals. The commercial values above only represent one "use" of the groundfish resources.

Table 6-1 presents the estimated cost of groundfish fishery management in a "typical" year in the period 2002-2006. Often the cost estimates are based on operations in the 2003 Federal year, the most recently completed fiscal year at the time the estimates were completed (May 2004). In some instances they incorporate projections; for example, the estimates for the NMFS Alaska Region's Restricted Access Management Program are estimates of anticipated costs following implementation of the new Crab Rationalization Program. Almost all of the agencies listed here have multiple functions. Often an activity - such as a Coast Guard patrol - will carry out a wide range of tasks in addition to supporting groundfish management. It has therefore often been impossible for agency staff to separate groundfish management costs from overall expenditures, or to separate out GOA and BSAI groundfish management expenditures from groundfish expenditures. Where agency staff did not feel they had a basis on which to make an estimate, no estimate has been provided. In general, estimates are provided to the hundred thousand dollar level. This convention may reasonably approximate costs in some instances where budgets are relatively small and well defined criteria exist for making estimates. In other instances, the reader should be aware that they may provide an undue sense of precision. In general, these estimates are very rough.

The general procedure has been to get budget information from the various departments and to allocate that to groundfish, GOA groundfish, and BSAI groundfish drawing on agency expertise. There are a number of problems inherent with this process. Many activities produce multiple outcomes and it is difficult or impossible to assign their costs to one of those outcomes. Often there is no clear bright line between fishery management activities and other activities. In many cases, the appropriate criteria for allocating costs to one activity or another were not well defined. Much of this analysis depends on the judgement of agency analysts, and the use of different analysts for each agency means that differing judgements might have been used by different agencies. For all of these reasons, the reader should be aware that these estimates can only be treated as rough approximations.

Table 6-1 Estimated cost of fishery management by government agencies. Estimates are expressed in millions of dollars. Note: These estimates are rough approximations.

Agency	Function	Overall Alaska region expenditures	Groundfish fisheries	GOA	BSAI
North Pacific Fishery Management Council (Council)	The Council is one of eight regional councils established by the Magnuson Fishery Conservation and Management Act in 1976 (which has been renamed the Magnuson-Stevens Fishery Conservation and Management Act) to oversee management of the nation's fisheries. With jurisdiction over the 900,000 square mile Exclusive Economic Zone (EEZ) off Alaska, the Council has primary responsibility for groundfish management in the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands (BSAI), including cod, pollock, flatfish, mackerel, sablefish, and rockfish species harvested mainly by trawlers, hook and line longliners and pot fishermen. The Council also makes allocative and limited entry decisions for halibut, though the U.S. - Canada International Pacific Halibut Commission (IPHC) is responsible for conservation of halibut. Other large	$3.0	$2.4	$0.8	$1.6

Agency		Function	Overall Alaska region expenditures	Groundfish fisheries	GOA	BSAI
National Marine Fisheries Service (Alaska Region)			Estimates below by division			
	Sustainable Fisheries Division (SFD)	The SFD implements the intent of the Council and NOAA Fisheries approved management programs consistent with the Magnuson-Stevens Act and other applicable law. SFD coordinates with the State of Alaska on the development of management programs, including halibut subsistence, and the International Pacific Halibut Commission on the development of regulations governing the Pacific halibut fishery off Alaska. SFD collects and manages catch data from North Pacific groundfish fisheries, develops and maintains information systems for integrating catch and observer data for estimating species specific total catch and uses those data to manage fisheries in an orderly and safe manner while maintaining harvest amounts within specified total allowable catch and prohibited species catch limits. SFD staff provides current and historic fishery statistics to other government agencies and the public, maintaining the confidentiality of protected statistics; and providing guidance to the Council and other management agencies on implementation and monitoring considerations of proposed management measures. The SFD administers and manages the Western Alaska Community Development Program so that allocations of groundfish, crab, and halibut quotas to the CDQ groups are accomplished consistent with applicable law and are harvested within established administrative and fishery management regulations to provide the maximum economic benefits to western Alaska communities.	$3.6	$2.9	$0.9	$2.0
	Protected Resources Division (PRD)	The PRD is responsible under the Endangered Species Act (ESA) for consultations on Federal actions that may affect listed marine mammal species for which NMFS has trust responsibility. NMFS is also responsible for recovering listed protected species to the point that they are no longer in danger of extinction and may be removed from listing under the ESA.	$2.2	$0.8	No estimate provided	
	Habitat Conservation Division (HCD)	The HCD carries out NOAA Fisheries' statutory responsibilities for habitat conservation in Alaska under the Magnuson-Stevens Fishery Conservation and Management Act, Fish and Wildlife Coordination Act, National Environmental Policy Act, Federal Power Act, and other laws. HCD has two principal programs: identification and conservation of Essential Fish Habitat (EFH) through fishery management, and environmental review of non-fishing activities that may adversely affect EFH or other habitats for living marine resources. HCD also supports habitat restoration projects in conjunction with the NOAA Fisheries Restoration Center. HCD has staff located in the Alaska Regional Office in Juneau and a field office in Anchorage.	$1.6	$0.4	$0.2	$0.2
	Restricted Access Management (RAM)	RAM implements the Alaska Region's licensing and permitting programs. Specific duties within that broad mandate include calculation and issuance of Individual Fishing Quota (IFQ) permits in the halibut and sablefish IFQ program, together with annual issuance of related permits and licenses, cost recovery activities mandated by the Magnuson-Stevens Act, and determinations on applications for transfers, hired skippers, and other program elements. Additionally, RAM oversees implementation of several other licensing programs, including the North Pacific groundfish and crab License Limitation program (LLP), the Federal Fisheries and Processing Permit program, and vessel, processor, and cooperative permitting under the American Fisheries Act . During FY03, RAM assumed responsibilities for implementation of the subsistence halibut program.	$1.9	$0.4	$0.3	$0.1

Agency		Function	Overall Alaska region expenditures	Groundfish fisheries	GOA	BSAI
	Other NMFS-AKR organizational units: Regional Directorate, Operations, Management & Information	Fulfills a variety of Regional leadership & coordination roles. Includes: workload competence, quality, and management. IT support, grants administration, administrative appeals. Finance & logistical support. NEPA coordination & compliance, preparation of NEPA, E.O. 12866, and Reg Flex analyses for other divisions.	$6.2	$3.5	$1.0	$2.5
	Grants administered by the Alaska Region	The Alaska Region dispenses millions of dollars in grants for fishery management administration and research. Grants to the State of Alaska to assist with groundfish related activity are discussed below, under the line for the State of Alaska. In general, there are few other funds distributed for groundfish related projects. Considerable funding is used for marine mammal related projects, and in recent years large sums have been dispensed for Steller sea lion (SSL) research. In FY 2003, total marine mammal related grants were about $13 million, of which about $11 million were for SSL research. While much of this marine mammal work will have implications for groundfish management, it serves many other purposes as well, and cannot be considered primarily a groundfish management cost item. It is therefore not listed in the summary columns.	Grants to the state are described below. No additional significant grants specifically for groundfish.			
Alaska Fisheries Science Center (AFSC)			Estimates below by division			
	Resource Assessment and Conservation Engineering Division (RACE)	The RACE Division conducts fishery surveys to measure the distribution and abundance of approximately 40 commercially important fish and crab stocks in the eastern Bering Sea, Gulf of Alaska, and marine waters off California, Oregon, and Washington. Data derived from these surveys are analyzed by Center scientists and supplied to fishery management agencies and to the commercial fishing industry.	$17.7	$13.6	$5.8	$7.8
	Resource Ecology and Fisheries Management (REFM)	The REFM Division conducts research and data collection to support management of Northeast Pacific and eastern Bering Sea fish and crab resources. Groundfish and crab stock assessments are developed annually and used by the Pacific and North Pacific Fishery Management Councils to set catch quotas (based on assessments). Division scientists also evaluate how fish stocks and user groups might be affected by fishery management actions.	$11.2	$10.7	$3.2	$7.5
	Auke Bay Lab (ABL)	ABL has housed federal fisheries research in Alaska since 1960. The laboratory is located 12 miles north of Juneau and consists of six research programs.	$12.0	$3.9	$2.9	$1.0
NOAA Office of General Counsel - Alaska Region		The NOAA General Counsel serves as the chief legal officer for the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. The position of the NOAA General Counsel was established in section 2(e)(1) of Reorganization Plan No. 4 of 1970 that created NOAA. The General Counsel is appointed by the Secretary of Commerce, with the approval of the President. The Office of the General Counsel provides legal service and guidance for all matters that may arise in the conduct of NOAA's missions. The Office of the Alaska Regional Counsel (GCAK)s co-located with the Alaska Region of the NOAA National Marine Fisheries Service (NMFS) in Juneau, Alaska. GCAK provides legal advice and assistance on issues related to the administration of NOAA programs in Alaska.	$2.0	No estimates provided		

Agency	Function	Overall Alaska region expenditures	Groundfish fisheries	GOA	BSAI
NOAA Office of Law Enforcement - Alaska Region	NOAA Fisheries Office for Law Enforcement is dedicated to the enforcement of laws that protect and conserve our nation's living marine resources and their natural habitat. NOAA Fisheries special agents and enforcement officers have specified authority to enforce over 100 legislative acts under 32 statutes, as well as numerous treaties related to the conservation and protection of marine resources and other matters of concern to NOAA. These are projected FY2004 costs. They do not include costs of sablefish IFQ enforcement. IFQ halibut and IFQ sablefish enfrorcement were so interlinked, staff was unable to break out the costs. Total IFQ enforcement expenditures were projected to be $1.73 million.	$5.0	$2.4	$1.8	$0.6
United States Coast Guard - 17th District (USCG)	The Coast Guard supports the groundfish fisheries by providing at-sea enforcement of all domestic fishery regulations. The numbers provided cannot capture the accurate cost of domestic fishery enforcement. Because all Coast Guard ships and aircraft are multi-mission platforms, counting all fishery resources hours expended will overestimate the cost. The Coast Guard does not conduct patrols that strictly examine fishery regulations nor does any boarding conducted by the Coast Guard look only for compliance with fishery regulations. All federal laws and regulations are enforced on every boarding. Because of that, the true cost of at-sea enforcement is something less than the number provided but a more accurate number is intangible. Many of the resource hours used to build these numbers would have been conducted in the absence of FMP requirements for enforcement. Such patrols would enforce safety regulations and/or drug laws, and interdict alien migration. Currently all of these are being enforced concurrently with fishery regulations. The numbers provided include resources from the Coast Guard budget in Alaska and the Pacific Area headquarters budget. This is necessary because some Coast Guard ships patrolling in Alaska come from the lower 48 or Hawaii, and are not funded from the Alaskan Coast Guard budget. The numbers are therefore not conducive to comparing amount spent on enforcement in Alaska to overall the Coast Guard budget in Alaska.		< $40.2	< $13.9	< $26.3
Alaska Department of Fish and Game (ADF&G)	The groundfish fisheries in the EEZ are a source of jobs and income for many residents of Alaska; groundfish stocks and fishing operations move across the line dividing state from federal jurisdiction; a large proportion of groundfish harvests from the EEZ are delivered to state ports and are recorded on state fish landings records. For all these reasons, the State of Alaska has a significant role in the management of groundfish stocks and fisheries in the EEZ. The state spends money to support the Council process. State managers are particularly important in the management of the demersal shelf rockfish fishery in the eastern GOA. The state spends money on port sampling of groundfish landings, collecting landings records, and data processing and analysis of landings records. The Alaska Board of Fisheries interacts with the Council and considers management proposals to better coordinate federal and state regulations. State ADF&G offices provide local sources of information on EEZ management rules for the public. A significant part of the state's contribution is supported with federal funding. The figure for groundfish represents the value of federal grants awarded to the state. This understatesADF&G expenditures.		>$2.5	No estimates provided	

Agency	Function	Overall Alaska region expenditures	Groundfish fisheries	GOA	BSAI
Other agencies of the State of Alaska	The Alaska Commercial Fisheries Entry Commission processes landings records and Commercial Operators' Annual Reports reports and is an important source for price information for shoreside landings; the Alaska Department of Commerce monitors CDQ group activity and is involved in the process of allocating CDQ among the groups; the Alaska Division of Measurement Standards checks scales for shoreside plants.	No estimate provided			
Fish and Wildlife Service (USFWS)	A representative of the USFWS serves on the Council and on the Ecosystem and Steller Sea Lion Mitigation committees. The USFWS is also represented on the Groundfish Planning Team. USFWS seabird and marine mammal expertise help provide a broader ecological perspective on fisheries management. In addition to long-term seabird and marine mammal population monitoring programs in the GOA and BSAI, USFWS staff are actively engaged with industry and NMFS to develop strategies and technologies to reduce the incidental take of seabirds in groundfish fisheries.	No estimate provided			
Alaska Fisheries Information Network (AKFIN)	AKFIN is a cooperative data program of the Pacific States Marine Fishery Commission, Alaska Department of Fish and Game, Commercial Fisheries Entry Commission, North Pacific Fisheries Management Council, and NOAA. AKFIN transfers, analyzes, and processes agency fishery data for reporting. AKFIN integrates and aggregates all state and federal harvest and value to produce data sets for FMP analyses and reports such as *Fisheries of the US.*	$0.8	$0.7	$0.4	$0.3
North Pacific Research Board (NPRB)	The NPRB's mission is to develop a comprehensive science program of the highest caliber to enhance understanding of the North Pacific, Bering Sea, and Arctic Ocean ecosystems and fisheries. It conducts its work through science planning, prioritization of pressing fishery management and ecosystem information needs, coordination and cooperation among research programs, competitive selection of research projects, increased information availability, and public involvement. The NPRB will seek to avoid duplicating other research. The NPRB expects to support $5 to $6 million in new research each year. Its annual administrative budget is about $0.85 million budget. The groundfish estimate includes NPRB 2003 expenditures for groundfish projects already funded, matching funds provided by grantees, and a third of the agency's annual budget. Costs associated with the NPRB may also be reflected in budgets for other agencies. For example, the ABL has used funds from the NPRB for Aleutian Islands coral investigations. The NPRB reports the $0.8 was expended on this project in 2003, and that there were $0.3 in matching funds.		$5.5	Not estimated	
Costs incurred by the private sector	The private sector incurs costs that could fairly be described as management costs. These include the costs of the paperwork associated with the management system, the private costs associated with the observer program, the costs of operating various cooperative or CDQ catch management programs, and the costs of participating in the Council and regulatory processes[1].	for paperwork: for observers:	$3.7 >$10.8	> $1.1	> $9.7

[1] The line between the costs of management and the costs associated with advocacy in the Council process, or with the normal management of an independent business, can be hard to draw. Some of the more important components of this cost item include:

- Costs incurred by private citizens, fisheries organizations, environmental organizations, and other private parties for participation in the Council process.
- Costs of meeting observer requirements (about $10.8 million per year - using 2002 observer days and a cost of $365/day). These provide a low estimate of the total cost of the observer program to fishing operations because fishing operations incur economic and operational impacts that are not directly reflected in the money they must spend on observer coverage. Fishing vessel operators may have to alter their travel plans and schedules to pick up or drop off observers; the observers take up limited space on vessels. Provisions must be made to accommodate the necessary work of the observer on deck (e.g., observing gear setting and retrieval, recording and sampling of catch and bycatch). The observer also occupies "living space" aboard, which otherwise could have housed additional crew members. These

operational impacts may be reflected in both increased operating expenses and reduced harvests and revenues. It is not possible, with available information, to quantify these effects, but they may represent a substantial additional cost of operation.

- CDQ groups have significant responsibilities for managing target and non-target quotas. This quota management function may involve personnel and data processing contracts. AFA cooperatives similarly are involved in quota management.
- CDQ groups and AFA cooperatives, and other fishermen, contract with private firms to provide fishing companies with rapidly updated information about the location of PSC bycatch hotspots. Fishing companies are then able to alter their fishing behavior so as to avoid areas with high PSC bycatch. By reducing PSC bycatch, companies are able to extend fishing seasons and avoid other constraints on fishing activity.
- NMFS collects fees from fishermen to offset the costs of managing sablefish IFQ programs. In 2003, NMFS collected an estimated $1.0 million in sablefish cost recovery fees. These costs are already reflected in NMFS spending described above, and should not be counted a second time. However, they do represent a management cost incurred by industry, and are reported here to capture this distributive effect.

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Bering Sea and Aleutian Islands Groundfish Fishery Management Plan

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Appendix A History of the Fishery Management Plan

The Fishery Management Plan (FMP) for Bering Sea / Aleutian Islands (BSAI) Groundfish was implemented on January 1, 1982. Since that time it has been amended over seventy times, and its focus has changed from the regulation of mainly foreign fisheries to the management of fully domestic fisheries. The FMP was substantially reorganized in Amendment 83. Outdated catch data or other scientific information, and obsolete references, were also removed or updated.

Section A.1 contains a list of amendments to the FMP since its implementation in 1982. A detailed account of each of the FMP amendments, including its purpose and need, a summary of the analysis and implementing regulations, and results of the amendment, is contained in Appendix C to the *Final Programmatic Supplemental Environmental Impact Statement for the Alaska Groundfish Fisheries*, published by National Marine Fisheries Service (NMFS) in 2004.

A.1 Amendments to the FMP

Amendment 1, implemented January 1, 1984, supercedes Amendments 2 and 4:

1. Established a multi-year, multi-species optimum yield for the groundfish complex.
2. Established a framework procedure for determining and apportioning total allowable catch (TAC), reserves, and domestic annual harvest (DAH).
3. Eliminated the “Misty Moon” grounds south of the Pribilof Islands from the Winter Halibut Savings Area.
4. Allowed experimental year-round domestic trawling in the Winter Halibut Savings Area that will be closely monitored to the extent possible.
5. Allowed year-round domestic trawling in the Bristol Bay Pot Sanctuary and year-round domestic longlining in the Winter Halibut Savings Area.
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.
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 (PSC) 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 joint venture processing (JVP) 25,000 mt from 850 mt, and decreased total allowable level of foreign fishing (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 maximum sustainable yield to 55,000 mt from 58,700 mt, increased equilibrium yield to 160,000 mt from 58,700 mt, increased acceptable biological catch to 160,000 mt from 58,700 mt, increased optimum yield to 78,700 mt from 58,700 mt, increased reserves to 3,935 mt from 2,935 mt, increased domestic annual processing (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.
2. Established a Council policy on the domestic groundfish fisheries and their incidental catch of prohibited species.

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 acceptable biological catch to 79,714 mt, optimum yield to 77,314 mt, and reserves to 3,866 mt.
6. For Pacific Cod, increased equilibrium yield and acceptable biological catch to 168,000 mt from 160,000 mt, increased optimum yield 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 maxiumum sustainable yield 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 l70°30'W and l72°W and south of the Aleutians between l70°W and l72°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 limit 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.

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 l70°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 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 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 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, replaced Amendment 10:

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 (“A” season) and non roe-bearing (“B” season). The percentage of the TAC allocated to each allowance shall be determined annually during the TAC specifications process.

Amendment 15, approved by the Secretary on January 29, 1993, implemented March 15, 1995:

1. Established an Individual Fishing Quota (IFQ) program for directed fixed gear sablefish fisheries in the Bering Sea and Aleutian Islands management areas.
2. Established a Western Alaska Community Development Quota (CDQ) Program.

Amendment 16, implemented January 1, 1991, replaced Amendment 12a:

1. Extended the effective dateof Amendment 12a (originally scheduled to expire December 31, 1990) with the following three changes:
   (1) PSC apportionments would be established for the DAP rock sole and deep water turbot/arrowtooth flunder fisheries;
   (2) PSC limits could be seasonally apportioned; and
   (3) 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.

Amendment 16a implemented on July 12, 1991.

1. Established inseason authority to temporarily close statistical areas, or portions thereof, to reduce high prohibited species bycatch rates;.

2. Provided authority to the Regional Administrator, in consultation with the Council, to set a limit on the amount of the pollock TACs that may be taken with other than pelagic trawl gear.
3. Established a framework for determining an annual herring PSC limit as 1% of the estimated herring biomass, attainment of which triggers trawl closures in three Herring Savings Areas.

Amendment 17 implemented on April 24, 1992:

1. Authorize the NMFS Regional Administrator to approve experimental fishing permits after consultation with the Council.
2. Establish a unique Bogoslof District as part of the Bering Sea subarea, for which a pollock harvest quota would be annually specified. Fishing for pollock in the remaining parts of the Bering Sea subarea will be unaffected by any closure of the Bogoslof District.

Amendment 18 implemented on June 1, 1992 and revised Amendment 18 on December 18, 1992:

1. The Pollock TAC in the BSAI, after subtraction of the reserve, is allocated between inshore and offshore components during the years 1992 through 1995. The inshore component receives 35% of the pollock TAC, and the offshore component receives 65%.
2. A Catcher Vessel Operational Area (CVOA) is established to limit access to pollock within the area to catcher vessels delivering to the inshore component. This area is between 163° and 168° W. longitude, south of 56° N latitude, and north of the Aleutian Islands. During the 1992 "B" season, the offshore component will not be allowed to fish within the CVOA.
3. Half of the amount of BSAI pollock assigned to the nonspecific reserve (7.5% of the BSAI TAC) is allocated as Western Alaska CDQ program.

Amendment 19 implemented on September 23, 1992, supplemented Amendment 16:

1. Revise time/area closure (hotspot) authority in the BSAI to authorize, by regulatory amendment, the establishment of time/area closures to reduce bycatch rates of prohibited species. Any closure of an area would require a determination by the Secretary, in consultation with the Council.
2. Expand the Vessel Incentive Program (VIP) to include all trawl fisheries in the BSAI.
3. Delay opening of all trawl fisheries in the BSAI until January 20. The opening date for non-trawl fisheries, including hook and line, pot and jigging, will continue to be January 1.
4. Establish, for the 1992 season only, a halibut PSC limit of 5,033 mt for the BSAI trawl fishery. Also, a 750 mt halibut PSC mortality limit for the non-trawl fisheries will be established for one year.
5. Establish new halibut and crab PSC apportionment categories. A trawl fishery category closes when it reaches a PSC bycatch allowance allocated to that category.
6. Establish new fishery definitions. The fishery definitions for both the Vessel Incentive Program and the PSC allowance limits would be the same. The definitions of fisheries for these programs would be as follows:
   a. Mid-water pollock if pollock is ≥ to 95% of the total catch.
   b. Other targets determined by the dominate species in terms of retained catch.
   c. For the BSAI, a flatfish fishery consisting of rocksole, yellowfin sole, and other flatfish (excluding Greenland turbot and arrowtooth flounder) will be defined and then subdivided into three fisheries. If yellowfin sole accounts for at least 70% of the retained flatfish catch, it is a yellowfin sole fishery. Otherwise, it is a rock sole or other flatfish fishery depending on the which is dominant in terms of retained catch.
7. To allow more effective enforcement of directed fishery closures and to further limit trawl bycatch amounts of halibut after a halibut PSC bycatch allowance has been reached, changes to Directed Fishing Standards include:

a. Directed fishing standards would be seven percent of the aggregate amounts of GOA and BSAI groundfish other than pollock, that are caught while fishing for pollock with pelagic trawl gear.
b. For purposes of the directed fishing rule, the operator of a vessel is engaged in a single fishing trip, from the date when fishing commences or continues in an area after the effective date of a notice prohibiting directed fishing in that area, until the first date on which at least one of following occurs: 1) a weekly reporting period ends; 2) the vessel enters or leaves a reporting area for which an area specific TAC or directed fishing standard is established; or 3) any fish or fish product is offloaded or transferred from that vessel.

Amendment 20 implemented on January 19, 1992:

Prohibit trawling year round in the BSAI within 10 nautical miles of 27 Steller sea lion rookeries. In addition, five of these rookeries will have 20 nautical mile trawl closures during the pollock "A" season. These closures will revert back to 10 nautical miles when the "A" season is over, either on or before April 15.

Amendment 21 implemented on March 17, 1993, superceded Amendment 16:

Established FMP authority to specify trawl and non-trawl gear halibut bycatch mortality limits by regulatory amendment.

Amendment 21a implemented on January 20, 1995:

Established a Pribilof Islands Habitat Conservation Area.

Amendment 21b implemented on November 29, 1995:

Established trawl closure areas called the Chinook Salmon Savings Areas.

Amendment 22 implemented on December 22, 1992:

Established trawl test areas for the testing of trawl gear in preparation of the opening of fishing seasons. Fishermen are allowed to test trawl gear when the BSAI would otherwise be closed to trawling.

Amendment 23, implemented on August 10, 1995 and effective on September 11, 1995:

Created a moratorium on harvesting vessels entering the BSAI groundfish fisheries other than fixed gear sablefish after January 1, 1996. The vessel moratorium will last until the Council replaces or rescinds the action, but in any case will end on December 31, 1998. The Council extended the moratorium to January 1, 1999 under Amendment 59. The Council may however extend the moratorium up to 2 additional years, if a permanent limited access program is imminent.

Amendment 24 implemented on February 28, 1994, and effective through December 31, 1996:

1. Established the following gear allocations of BSAI Pacific cod TAC as follows: 2% to vessels using jig gear; 44.1% to vessels using hook-and-line or pot gear, and 53.9% to vessels using trawl gear.
2. Authorized the seasonal apportionment of the amount of Pacific cod allocated to gear groups. Criteria for seasonal apportionments and the seasons authorized to receive separate apportionments will be set forth in regulations.

Amendment 25 implemented on May 20, 1994, superceded Amendment 21:

Eliminated the primary halibut bycatch mortality limit established for the trawl gear fisheries (3,300 mt). The overall bycatch mortality limit established for these fisheries (3,775 mt) remained unchanged.

Amendment 26 implemented on July 24, 1996:

Established a Salmon Donation Program that authorizes the voluntary retention and distribution of salmon taken as bycatch in the groundfish trawl fisheries off Alaska to economically disadvantaged individuals.

Amendment 27 implemented on October 6, 1994, superceded Amendments 13 and 18, repealed and replaced by Amendment 47:

Implemented language changes to the Fishery Management Plans to indicate that observer requirements under the FMPs are contained in the North Pacific Fisheries Research Plan.

Amendment 28 implemented on August 11, 1993, supplemented Amendment 20:

Established three districts in the Aleutian Islands management subarea for purposes of distributing the groundfish TACs spatially.

Amendment 29 not submitted

Amendment 30 implemented on September 23, 1994, revised Amendment 18:

Raised the CDQ allocation limit for qualified applicants from 12% to 33%.

Amendment 31 implemented on November 7, 1994, revised Amendment 15:

Implemented the Modified Block plan to prevent excessive consolidation of the halibut and sablefish fisheries, and clarifies the transfer process for the IFQ program.

Amendment 32 implemented on February 23, 1996, revised Amendment 15:

Established a one-time transfer of halibut and sablefish IFQ for CDQ.

Amendment 33 implemented on July 26, 1996, revised Amendment 15:

Allowed freezing of non-IFQ species when fishing sablefish IFQ.

Amendment 34 implemented on January 30, 1994:

Allocated Atka mackerel to vessels using jig gear. Annually, up to 2% of the TAC specified for this species in the eastern Aleutian Islands District/Bering Sea subarea will be allocated to vessels using jig gear in this area.

Amendment 35 implemented on August 1, 1995:

Established a trawl closure area called the Chum Salmon Savings Area.

Amendment 36 implemented on April 16, 1998:

Defined a forage fish species category and authorized that the management of this species category be specified in regulations in a manner that prevents the development of a commercial directed fishery for forage fish which are a critical food source for many marine mammal, seabird and fish species.

Amendment 37 implemented on January 1, 1997

Established a non-pelagic trawl closure area called the Red King Crab Savings Area, a trawl closure area called the Nearshore Bristol Bay Trawl Closure, and revised the red king crab PSC limits.

Amendment 38 implemented on January 1, 1996, superceded Amendment 18:

Extended provision of Amendment 18, inshore/offshore allocation and modified the Catcher Vessel Operating Area.

Amendment 39, implemented on January 1, 1999, except for some parts on January 1, 2000, replaced Amendment 23 and revised Amendment 18:

1. Created a license program for vessels targeting groundfish in the BSAI, other than fixed gear sablefish that is pending regulatory implementation. The license program will replace the vessel moratorium and will last until the Council replaces or rescinds the action.
2. Allocated 7.5% of groundfish TACs to the CDQ multispecies fishery.

Amendment 40 implemented on January 21, 1998:

Established PSC limits for *C. opilio* crab in trawl fisheries and a snow crab bycatch limitation zone.

Amendment 41 implemented on April 23, 1997, revised Amendment 12a:

Revised the *C. bairdi* Tanner crab PSC limit in Zones 1 and 2.

Amendment 42 implemented on August 16, 1996, revised Amendment 15

Increased sweep-up levels for small quota share blocks for sablefish managed under the sablefish and halibut IFQ program.

Amendment 43 implemented on December 20, 1996, revised Amendment 15:

Established sweep-up provisions to consolidate very small quota share blocks for halibut and sablefish.

Amendment 44 implemented on January 9, 1997, revised Amendment 16:

Established a more conservative definition of overfishing.

Amendment 45 implemented on January 21, 1999, superceded Amendment 38:

Reauthorized the pollock CDQ allocation.

Amendment 46 implemented on January 1, 1997, superceded Amendment 24:

Replaced the three year Pacific cod allocation established with Amendment 24, with the following gear allocations in BSAI Pacific cod: 2 percent to vessels using jig gear; 51 percent to vessels using hook-and-line or pot gear; and 47 percent to vessels using trawl gear. The trawl apportionment will be divided 50% to catcher vessels and 50% to catcher processors. These allocations as well as the seasonal apportionment authority established in Amendment 24 will remain in effect until amended.

Amendment 47 was not submitted

Amendment 48 was approved by the Council in October, 2003:

Revised the Total Allowable Catch specifications process, and changed the title of the FMP.

Amendment 49 implemented on January 3, 1998:

Implemented an Increased Retention/Increased Utilization Program for pollock and Pacific cod beginning January 1, 1998 and rock sole and yellowfin sole beginning January 1, 2003.

Amendment 50 implemented on July 13, 1998, revised Amendment 26:

Established a Prohibited Species Donation Program that expands the Salmon Donation Program to include halibut taken as bycatch in the groundfish trawl fisheries off Alaska to economically disadvantaged individuals.

Amendment 51 was partially implemented on January 20, 1999, superceded Amendment 38:

Replaced the three year Inshore/Offshore allocation established with Amendment 38, with the following allocations of BSAI pollock after subtraction of reserves: 39 percent inshore; 61 percent offshore. That portion of the Bering Sea inshore "B" season allocation which is equivalent to 2.5 percent of the BSAI pollock TAC, after subtraction of reserves, shall be made available only to vessels under 125 ft length overall for delivery to the inshore sector, prior to the Bering Sea "B" season, starting on or about August 25. Any overages or underages will be subtracted/added as part of the inshore B-season. The rules and regulations pertaining to the CVOA shall remain the same, except that during the B season, operations in the CVOA will be restricted to catcher vessels delivering to the inshore sector. These allocations will remain in effect until December 31, 2001, unless replaced by another management regime approved by the Secretary.

Amendment 52 was not submitted

Amendment 53 implemented July 22, 1998:

Allocates shortraker and rougheye rockfish TAC 70 percent to trawl fisheries and 30 percent to non-trawl fisheries.

Amendment 54 implemented on April 29, 2002, revised Amendment 15:

Revised use and ownership provisions of the sablefish IFQ program.

Amendment 55 implemented on April 26, 1999:

Implemented the Essential Fish Habitat (EFH) provisions contained in the Magnuson-Stevens Fishery Conservation and Management Act and 50 CFR 600.815. Amendment 55 describes and identifies EFH fish habitat for BSAI groundfish and describes and identifies fishing and non-fishing threats to BSAI groundfish EFH, research needs, habitat areas of particular concern, and EFH conservation and enhancement recommendations.

Amendment 56 implemented on March 8, 1999, revised Amendment 44:

Revised the overfishing definition.

Amendment 57 implemented on June 15, 2000, revised Amendment 37 and Amendment 40:

1. Prohibited the use of nonpelagic trawl gear in the directed pollock fishery.
2. Reduced the PSC limit for red king crab by 3,000 animals.

Amendment 58 implemented on November 13, 2000, revised Amendment 21b:

Revised Chinook Salmon Savings Areas trawl closure areas.

Amendment 59 implemented on January 19, 1999, superceded Amendment 23:

Extended the vessel moratorium through December 31, 1999.

Amendment 60 implemented on October 24, 2001 and January 1, 2002; superceded Amendment 59:

1. Required that the vessel would be a specific characteristic of the license and could not be severed from it.
2. Authorized license designations for the type of gear to harvest LLP groundfish as either "trawl" or "non-trawl" gear (or both).
3. Rescinded the requirement that CDQ vessels hold a crab or groundfish license.
4. Added a crab recency requirement which requires one landing during 1/1/96-2/7/98 in addition to the general license and area endorsement qualifications.
5. Allowed limited processing (1 mt) for vessels <60' LOA with catcher vessel designations.

Amendment 61 implemented on January 21, 2000, conformed the FMP with the American Fisheries Act (AFA) of 1998 that:

1. Removed excess capacity in the offshore pollock sector through the retirement of 9 factory trawlers.
2. Established U.S. ownership requirements for the harvest sector vessels.
3. Established specific allocations of the BSAI pollock quota as follows - 10% to the western Alaska CDQ program, with the remainder allocated 50% to the onshore sector, 40% to the offshore sector, and 10% to the mothership sector.
4. Identified the specific vessels and processors eligible to participate in the BSAI pollock fisheries
5. Established the authority and mechanisms by which the pollock fleet can form fishery cooperatives.
6. Established specific measures to protect the non-AFA (non-pollock) fisheries from adverse impacts resulting from the AFA or pollock fishery cooperatives.

Amendment 62 is pending, revised Amendment 61:

Would relax single geographic location restrictions for floating AFA processors.

Amendment 63 is pending:

Would revise management of non-target species.

Amendment 64 implemented on September 1, 2000, revised Amendment 46:

Allocated the Pacific cod Total Allowable Catch to the jig gear (2%), fixed gear (51%), and trawl gear (47%) sectors.

Amendment 65 was not submitted.

Amendment 66 implemented on April 6, 2002:

Exempted squid from the CDQ program.

Amendment 67 implemented on May 15, 2002, revised Amendment 39:

Established participation and harvest requirements to qualify for a BSAI Pacific cod fishery endorsement for fixed gear vessels.

Amendment 68 was not submitted.

Amendment 69 implemented March 13, 2003, revised Amendment 61:

Allows an inshore pollock cooperative to contract with AFA catcher vessels that are qualified for the inshore sector, but outside their cooperative, to harvest the cooperative's pollock allocation.

Amendment 70 was not submitted.

Amendment 71 is pending:
Would make administrative changes to the Western Alaska CDQ program.

Amendment 72 implemented August 28, 2003, revised Amendment 15:
Required a verbal departure report instead of a vessel clearance requirement for vessels with IFQ halibut or sablefish leaving the jurisdiction of the Council.

Amendment 73 was not submitted.

Amendment 74 was not submitted.

Amendment 75 was partially approved on May 29, 2003, revised Amendment 49:
Delayed indefinitely the implementation of the flatfish retention and utilization requirements.

Amendment 76 was not submitted.

Amendment 77 implemented January 1, 2004, revised Amendment 64:
Implemented a Pacific cod fixed gear allocation between hook and line catcher processors (80%), hook and line catcher vessels (0.3%), pot catcher processors (3.3%), pot catcher vessels (15%), and catcher vessels (pot or hook and line) less than 60 feet (1.4%).

Amendment 78 is pending, revised Amendment 55:
Would revise the EFH definitions.

Amendment 79 was approved by the Council in June 2003:
Would implement a groundfish retention standard in the non-AFA trawl catcher-processor fleet.

Amendment 80 is pending:
Would allocate groundfish (except pollock) to individual sectors and create a non-AFA trawl catcher-processor cooperative structure.

Amendment 81 was approved by the Council in April 2004:
Would replace the management policy in the FMP.

Amendment 82 is pending:

1. Created separate Chinook Salmon PSC limits for the Bering Sea and Aleutian Islands subareas, and modified the closures when the PSC limits are attained.
2. Allocated the directed pollock fishery in the AI subarea to the Aleut Corporation for the purpose of economic development in Adak, Alaska.

Amendment 83 is pending:
Would reorganize the FMP and update descriptive language.

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Appendix B Geographical Coordinates of Areas Described in the Fishery Management Plan

This appendix describes the geographical coordinates for the areas described in the Fishery Management Plan (FMP). This appendix divides the descriptions into three types: Bering Sea and Aleutian Islands (BSAI) management area, subareas, and districts (Section B.1), closed areas (Section B.2), and PSC bycatch limitation zones (Section B.3).

B.1 Management Area, Subareas, and Districts

Management Area

The management area for the BSAI groundfish FMP is the United States (U.S.) exclusive economic zone (EEZ) of the Bering Sea, including Bristol Bay and Norton Sound, and that portion of the North Pacific Ocean adjacent to the Aleutian Islands which is between 170° W longitude and the U.S.-Russian Convention Line of 1867. To the north, the management area is bounded by the Bering Strait.

Subareas

Two subareas are described in Section 3.1 of the FMP and are defined as follows:

Bering Sea subarea:	The area of the EEZ east of 170° W. longitude that is north of the Aleutian Islands, and the area of the EEZ west of 170° W. longitude that is north of 55° N. latitude.
Aleutian Islands subarea:	The area of the EEZ west of 170°W longitude and south of 55°N latitude.

Districts

The Bering Sea subarea contains one district, defined as follows:

Bogoslof District:	The area of the EEZ east of 170° W. longitude, west of 167° W. longitude, south of the straight line connecting the coordinates (55°46' N., 170° W.) and (54°30' N., 167° W.), and north of the Aleutian Islands.

The Aleutian Islands subarea is divided into three districts, defined as follows:

Eastern District:	That part of the Aleutian Islands subarea between 170° W longitude and 177° W longitude.
Central District:	That part of the Aleutian Islands subarea between 177° W longitude and 177° E longitude.
Western District:	That part of the Aleutian Islands subarea west of 177° E longitude.

B.2 Closed Areas

Specific areas of the BSAI are closed to some or all fishing during certain times of the year and are described in Section 3.5.2 of the FMP.

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.

Pribilof Islands Habitat Conservation Area

Trawling is prohibited at all times in the EEZ within the area bounded by a straight line connecting the following pairs of coordinates in the following order:

(57° 57.0' N.,	168° 30.0' W.)
(56° 55.2' N.,	168° 30.0' W.)
(56° 48.0' N.,	169° 2.4' W.)
(56° 34.2' N.,	169° 2.4' W.)
(56° 30.0' N.,	169° 25.2' W.)
(56° 30.0' N.,	169° 44.1' W.)
(56° 55.8' N.,	170° 21.6' W.)
(57° 13.8' N.,	171° 0.0' W.)
(57° 57.0' N.,	171° 0.0' W.)
(57° 57.0' N.,	168° 30.0' W.)

Chum Salmon Savings Area

Trawling is prohibited from August 1 through August 31 within the area bounded by a straight line connecting the following pairs of coordinates in the order listed:

(56°00' N., 167°00' W.)
(56°00' N., 165°00' W.)
(55°30' N., 165°00' W.)
(55°30' N., 164°00' W.)
(55°00' N., 164°00' W.)
(55°00' N., 167°00' W.)
(56°00' N., 167°00' W.)

Trawling is also prohibited for the remainder of the period September 1 through October 14 upon the attainment of an 'other salmon' bycatch limit; see Section B.3.

Red King Crab Savings Area

Non-pelagic trawling is prohibited year round within the area bounded by a straight line connecting the following pairs of coordinates in the order listed below:

(56° N., 162° W.)
(56° N., 164° W.)
(57° N., 164° W.)
(57° N., 162° W.)
(56° N., 162° W.)

with the exception that a subarea of the Red King Crab Savings Area between 56°00' and 56°10' N. latitude and 162° and 164° W. longitude may be opened as outlined in Section 3.5.2.1.

Nearshore Bristol Bay Trawl Closure

All trawling is prohibited year round in Bristol Bay east of 162° W. longitude, except the subarea bounded by a straight line connecting the following pairs of coordinates in the order listed below that is open to trawling during the period April 1 to June 15 each year:

(58°00' N., 160° W.)
(58°43' N., 160° W.)
(58°43' N., 159° W.)
(58°00' N., 159° W.)
(58°00' N., 160° W.)

Catcher Vessel Operational Area (CVOA)

The CVOA is defined as the area of the BSAI east of 167°30' W. longitude, west of 163° W. longitude, south of 56° N. latitude, and north of the Aleutian Islands. The CVOA shall be in effect during the pollock "B" season from September 1 until the date that closes the inshore component "B" season allocation to directed fishing. Vessels in the offshore component or vessels catching pollock for processing by the offshore component are prohibited from conducting directed fishing for pollock in the CVOA unless they are participating in a CDQ fishery.

B.3 PSC Limitation Zones

Specific areas of the management area are closed to some or all fishing during certain times of the year on attainment of a species-specific bycatch cap. These areas are described in Section 3.6.2.2 of the FMP.

Zones 1 and 2

Zones 1 and 2 are closed to directed fishing when the crab bycatch caps are attained in specified fisheries.

Zone 1: area bounded by 165° W. longitude and 58° N. latitude extending east to the shore.

Zone 2: 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.

Herring Savings Areas

The herring savings areas are all located within the Bering Sea subarea and are defined as follows:

Summer Herring Savings Area 1: area south of 57° N. latitude and between 162° and 164° W. longitude from 12:00 noon Alaska Local Time (ALT) June 15 through 12:00 noon ALT July 1 of a fishing year

Summer Herring Savings Area 2: area south of 56°30' N. latitude and between 164° and 167° W. longitude from 12:00 noon ALT July 1 through 12:00 noon ALT August 15 of a fishing year

Winter Herring Savings Area: area between 58° and 60° N. latitude and between 172° and 175° W. longitude from 12:00 noon ALT September 1 through 12:00 noon ALT March 1 of the succeeding fishing year

Chum Salmon Savings Area

Upon the attainment of the "other salmon" catch limit, trawling is prohibited for the remainder of the period September 1 through October 14 within the area bounded by a straight line connecting the following pairs of coordinates in the order listed:

(56°00' N., 167° W.)
(56°00' N., 165° W.)
(55°30' N., 165° W.)
(55°30' N., 164° W.)
(55°00' N., 164° W.)
(55°00' N., 167° W.)
(56°00' N., 167° W.)

Trawling is also prohibited absolutely in the area from August 1 through August 31; see description in Section B.2 above.

Chinook Salmon Savings Areas

Area 1: The area defined by straight lines connecting the following coordinates in the order listed:

(54° N., 171° W.)
(54° N., 170° W.)
(53° N., 170° W.)
(53° N., 171° W.)
(54° N., 171° W.)

Area 2: The area defined by straight lines connecting the following coordinates in the order listed:

(56°00' N., 165° W.)
(56°00' N., 164° W.)
(55°00' N., 164° W.)
(55°00' N., 165° W.)
(54°30' N., 165° W.)
(54°30' N., 167° W.)
(55°30' N., 167° W.)
(55°30' N., 165° W.)
(56°00' N., 165° W.)

C. Opilio Bycatch Limitation Zone (COBLZ)

Defined as that portion of the Bering Sea subarea north of 56°30' N. latitude and west of a line connecting the following coordinates in the order listed:

(56°30' N., 165° W.)
(58°00' N., 165° W.)
(59°30' N., 170° W.)

and north along 170° W. longitude to its intersection with the U.S.-Russia boundary.

Upon attainment of the COBLZ bycatch allowance of *C. opilio* crab specified for a particular fishery category, the COBLZ will be closed to directed fishing for each category for the remainder of the year or for the remainder of the season.

Appendix C Summary of the American Fisheries Act and Subtitle II

C.1 Summary of the American Fisheries Act (AFA) Management Measures

On October 21, 1998, the President signed into law the American Fisheries Act (AFA) that superceded the previous inshore/offshore management regime for Bering Sea and Aleutian Islands (BSAI) pollock adopted under Amendment 18 and extended under Amendments 23 and 51. With respect to the fisheries off Alaska, the AFA required several new management measures: (1) regulations that limit access into the fishing and processing sectors of the pollock fishery and that allocate pollock to such sectors, (2) regulations governing the formation and operation of fishery cooperatives in the pollock fishery, (3) regulations to protect other fisheries from spillover effects from the AFA, and (4) regulations governing catch measurement and monitoring in the pollock fishery.

The AFA is a complex piece of legislation with numerous provisions that affect the management of the groundfish and crab fisheries off Alaska. The AFA is divided into two subtitles. *Subtitle I – Fisheries Endorsements* includes nationwide United States (U.S.) ownership and vessel length restrictions for U.S. vessels with fisheries endorsements. These requirements are implemented by the Maritime Administration and the U.S. Coast Guard under the Department of Transportation and Department of Homeland Security, respectively. *Subtitle II – Bering Sea Pollock Fishery* contains measures related to the management of BSAI pollock fishery.

Key provisions of the AFA are listed below.

- A requirement that owners of all U.S. flagged fishing vessels comply with a 75 percent U.S. controlling interest standard.

- A prohibition on the entry of any new fishing vessels into U.S. waters that exceed 165 ft registered length, 750 gross registered tons, or 3,000 shaft horsepower.

- The buyout of nine pollock catcher/processors and the subsequent scrapping of eight of these vessels through a combination of $20 million in federal appropriations and $75 million in direct loan obligations.

- A new allocation scheme for BSAI pollock that allocates 10 percent of the BSAI pollock total allowable catch (TAC) to the Community Development Quota (CDQ) Program, and after allowance for incidental catch of pollock in other fisheries, allocates the remaining TAC as follows: 50 percent to vessels harvesting pollock for processing by inshore processors, 40 percent to vessels harvesting pollock for processing by catcher/processors, and 10 percent to vessels harvesting pollock for processing by motherships.

- A fee of six-tenths (0.6) of one cent for each pound round weight of pollock harvested by catcher vessels delivering to inshore processors for the purpose of repaying the $75 million direct loan obligation.

- A prohibition on entry of new vessels and processors into the BSAI pollock fishery. The AFA lists by name vessels and processors and/or provides qualifying criteria for those vessels and processors eligible to participate in the non-CDQ portion of the BSAI pollock fishery.

- An increase in observer coverage and scale requirements for AFA catcher/processors.

- New standards and limitations for the creation of fishery cooperatives in the catcher/processor, mothership, and inshore industry sectors.

- A quasi-individual fishing quota program under which National Marine Fisheries Service grants individual allocations of the inshore BSAI pollock TAC to inshore catcher vessel cooperatives that form around a specific inshore processor and agree to deliver at least 90 percent of their pollock catch to that processor.

- The establishment of harvesting and processing restrictions (commonly known as "sideboards") on fishermen and processors who have received exclusive harvesting or processing privileges under the AFA, to protect the interests of fishermen and processors who have not directly benefitted from the AFA.

- A 17.5 percent excessive share harvesting cap for BSAI pollock and a requirement that the Council develop excessive share caps for BSAI pollock processing and for the harvesting and processing of other groundfish.

C.2 American Fisheries Act: Subtitle II Bering Sea Pollock Fishery

SEC. 205. DEFINITIONS.

As used in this subtitle –

(1) the term "Bering Sea and Aleutian Islands Management Area" has the same meaning as the meaning given for such term in part 679.2 of title 50, Code of Federal Regulations, as in effect on October 1, 1998;

(2) the term "catcher/processor" means a vessel that is used for harvesting fish and processing that fish;

(3) the term "catcher vessel" means a vessel that is used for harvesting fish and that does not process pollock onboard;

(4) the term "directed pollock fishery" means the fishery for the directed fishing allowances allocated under paragraphs (1), (2), and (3) of section 206(b);

(5) the term "harvest" means to commercially engage in the catching, taking, or harvesting of fish or any activity that can reasonably be expected to result in the catching, taking, or harvesting of fish;

(6) the term "inshore component" means the following categories that process groundfish harvested in the Bering Sea and Aleutian Islands Management Area:

(A) shoreside processors, including those eligible under section 208(f); and

(B) vessels less than 125 feet in length overall that process less than 126 metric tons per week in round-weight equivalents of an aggregate amount of pollock and Pacific cod;

(7) the term "Magnuson-Stevens Act" means the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.);

(8) the term "mothership" means a vessel that receives and processes fish from other vessels in the exclusive economic zone of the United States and is not used for, or equipped to be used for, harvesting fish;

(9) the term "North Pacific Council" means the North Pacific Fishery Management Council established under section 302(a)(1)(G) of the Magnuson-Stevens Act (16 U.S.C. 1852(a)(1)(G));

(10) the term "offshore component" means all vessels not included in the definition of inshore component that process groundfish harvested in the Bering Sea and Aleutian Islands Management Area;

(11) the term "Secretary" means the Secretary of Commerce; and

(12) the term "shoreside processor" means any person or vessel that receives unprocessed fish, except catcher/processors, motherships, buying stations, restaurants, or persons receiving fish for personal consumption or bait.

SEC. 206. ALLOCATIONS.

(a) POLLOCK COMMUNITY DEVELOPMENT QUOTA. Effective January 1,1999, 10 percent of the total allowable catch of pollock in the Bering Sea and Aleutian Islands Management Area shall be allocated as a directed fishing allowance to the western Alaska community development quota program established under section 505(i) of the Magnuson-Stevens Act (16 U.S.C. 1855(i)).

(b) INSHORE/OFFSHORE. Effective January 1, 1999, the remainder of the pollock total allowable catch in the Bering Sea and Aleutian Islands Management Area, after the subtraction of the allocation under subsection (a) and the subtraction of allowances for the incidental catch of pollock by vessels harvesting other groundfish species (including under the western Alaska community development quota program) shall be allocated as directed fishing allowances as follows –

(1) 50 percent to catcher vessels harvesting pollock for processing by the inshore component;

(2) 40 percent to catcher/processors and catcher vessels harvesting pollock for processing by catcher/processors in the offshore component; and

(3) 10 percent to catcher vessels harvesting pollock for processing by motherships in the offshore component.

SEC. 207. BUYOUT.

(a) FEDERAL LOAN. Under the authority of sections 1111 and 1112 of title XI of the Merchant Marine Act, 1936 (46 U.S.C. App. 1279f and 1279g) and notwithstanding the requirements of section 312 of the Magnuson-Stevens Act (16 U.S.C. 1861a), the Secretary shall, subject to the availability of appropriations for the cost of the direct loan, provide up to $75,000,000 through a direct loan obligation for the payments required under subsection (d).

(b) INSHORE FEE SYSTEM. Notwithstanding the requirements of section 304(d) or 312 of the Magnuson-Stevens Act (16 U.S.C. 1854(d) and 1861a), the Secretary shall establish a fee for the repayment of such loan obligations which –

(1) shall be six-tenths (0.6) of one cent for each pound round-weight of all pollock harvested from the directed fishing allowance under section 206(b)(1); and

(2) shall begin with such pollock harvested on or after January 1, 2000, and continue without interruption until such loan obligation is fully repaid; and

(3) shall be collected in accordance with section 312(d)(2)(C) of the Magnuson-Stevens Act (16 U.S.C. 1861a(d)(2)(C)) and in accordance with such other conditions as the Secretary establishes.

(c) FEDERAL APPROPRIATION. Under the authority of section 312(c)(1)(B) of the Magnuson-Stevens Act (16 U.S.C. 1861a(c)(1)(B)), there are authorized to be appropriated $20,000,000 for the payments required under subsection (d).

(d) PAYMENTS. Subject to the availability of appropriations for the cost of the direct loan under subsection (a) and funds under subsection (c), the Secretary shall pay by not later than December 31, 1998 –

(1) up to $90,000,000 to the owner or owners of the catcher/processors listed in paragraphs (1) through (9) of section 209, in such manner as the owner or owners, with the concurrence of the Secretary, agree, except that –

(A) the portion of such payment with respect to the catcher/processor listed in paragraph (1) of section 209 shall be made only after the owner submits a written certification acceptable to the Secretary that neither the owner nor a purchaser from the owner intends to use such catcher/processor outside the exclusive economic zone of the United States to harvest any stock of fish (as such term is defined in section 3 of the Magnuson-Stevens Act (16 U.S.C. 1802)) that occurs within the exclusive economic zone of the United States; and

(B) the portion of such payment with respect to the catcher/processors listed in paragraphs (2) through (9) of section 209 shall be made only after the owner or owners of such catcher/processors submit a written certification acceptable to the Secretary that such catcher/processors will be scrapped by December 31, 2000 and will not, before that date, be used to harvest or process any fish; and

(2)(A) if a contract has been filed under section 210(a) by the catcher/processors listed in section 208(e), $5,000,000 to the owner or owners of the catcher/processors listed in paragraphs (10) through (14) of such section in such manner as the owner or owners, with the concurrence of the Secretary, agree; or

(B) if such a contract has not been filed by such date, $5,000,000 to the owners of the catcher vessels eligible under section 208(b) and the catcher/processors eligible under paragraphs (1) through (20) of section 208(e), divided based on the amount of the harvest of pollock in the directed pollock fishery by each such vessel in 1997 in such manner as the Secretary deems appropriate,

except that any such payments shall be reduced by any obligation to the federal government that has not been satisfied by such owner or owners of any such vessels.

(e) PENALTY. If the catcher/processor under paragraph (1) of section 209 is used outside the exclusive economic zone of the United States to harvest any stock of fish that occurs within the exclusive economic zone of the United States while the owner who received the payment under subsection (d)(1)(A) has an ownership interest in such vessel, or if the catcher/processors listed in paragraphs (2) through (9) of section 209 are determined by the Secretary not to have been scrapped by December 31, 2000 or to have been used in a manner inconsistent with subsection (d)(1)(B), the Secretary may suspend any or all of the federal permits which allow any vessels owned in whole or in part by the owner or owners who received payments under subsection (d)(1) to harvest or process fish within the exclusive economic zone of the United States until such time as the obligations of such owner or owners under subsection (d)(1) have been fulfilled to the satisfaction of the Secretary.

(f) PROGRAM DEFINED; MATURITY. For the purposes of section 1111 of the Merchant Marine Act, 1936 (46 U.S.C. App. 1279f), the fishing capacity reduction program in this subtitle shall be within the meaning of the term program as defined and used in such section. Notwithstanding section 1111(b)(4) of such Act (46 U.S.C. App. 1279f(b)(4)), the debt obligation under subsection (a) of this section may have a maturity not to exceed 30 years.

(g) FISHERY CAPACITY REDUCTION REGULATIONS. The Secretary of Commerce shall by not later than October 15, 1998 publish proposed regulations to implement subsections (b), (c), (d) and (e) of section 312 of the Magnuson-Stevens Act (16 U.S.C. 1861a) and sections 1111 and 1112 of title XI of the Merchant Marine Act, 1936 (46 U.S.C. App. 1279f and 1279g).

SEC. 208. ELIGIBLE VESSELS AND PROCESSORS.

(a) CATCHER VESSELS ONSHORE. Effective January 1, 2000, only catcher vessels which are –

(1) determined by the Secretary –

(A) to have delivered at least 250 metric tons of pollock; or

(B) to be less than 60 feet in length overall and to have delivered at least 40 metric tons of pollock,

for processing by the inshore component in the directed pollock fishery in any one of the years 1996 or 1997, or between January 1, 1998 and September 1, 1998;

(2) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary; and

(3) not listed in subsection (b),

shall be eligible to harvest the directed fishing allowance under section 206(b)(1) pursuant to a federal fishing permit.

(b) CATCHER VESSELS TO CATCHER/PROCESSORS. Effective January 1, 1999, only the following catcher vessels shall be eligible to harvest the directed fishing allowance under section 206(b)(2) pursuant to a federal fishing permit:

(1) AMERICAN CHALLENGER (United States official number 633219);

(2) FORUM STAR (United States official number 925863);

(3) MUIR MILACH (United States official number 611524);

(4) NEAHKAHNIE (United States official number 599534);

(5) OCEAN HARVESTER (United States official number 549892);

(6) SEA STORM (United States official number 628959);

(7) TRACY ANNE (United States official number 904859); and

(8) any catcher vessel –

(A) determined by the Secretary to have delivered at least 250 metric tons and at least 75 percent of the pollock it harvested in the directed pollock fishery in 1997 to catcher/processors for processing by the offshore component; and

(B) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary.

(c) CATCHERS VESSELS TO MOTHERSHIPS. Effective January 1, 2000, only the following catcher vessels shall be eligible to harvest the directed fishing allowance under section 206(b)(3) pursuant to a federal fishing permit:

(1) ALEUTIAN CHALLENGER (United States official number 603820);

(2) ALYESKA (United States official number 560237);

(3) AMBER DAWN (United States official number 529425);

(4) AMERICAN BEAUTY (United States official number 613847);

(5) CALIFORNIA HORIZON (United States official number 590758);

(6) MAR-GUN (United States official number 525608);

(7) MARGARET LYN (United States official number 615563);

(8) MARK I (United States official number 509552);

(9) MISTY DAWN (United States official number 926647);

(10) NORDIC FURY (United States official number 542651);

(11) OCEAN LEADER (United States official number 561518);

(12) OCEANIC (United States official number 602279);

(13) PACIFIC ALLIANCE (United States official number 612084);

(14) PACIFIC CHALLENGER (United States official number 618937);

(15) PACIFIC FURY (United States official number 561934);

(16) PAPADO II (United States official number 536161);

(17) TRAVELER (United States official number 929356);

(18) VESTERAALEN (United States official number 611642);

(19) WESTERN DAWN (United States official number 524423);

(20) any vessel –

(A) determined by the Secretary to have delivered at least 250 metric tons of pollock for processing by motherships in the offshore component of the directed pollock fishery in any one of the years 1996 or 1997, or between January 1, 1998 and September 1, 1998;

(B) eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary; and

(C) not listed in subsection (b).

(d) MOTHERSHIPS. Effective January 1, 2000, only the following motherships shall be eligible to process the directed fishing allowance under section 206(b)(3) pursuant to a federal fishing permit:

(1) EXCELLENCE (United States official number 967502);

(2) GOLDEN ALASKA (United States official number 651041);

(3) OCEAN PHOENIX (United States official number 296779).

(e) CATCHER/PROCESSORS. Effective January 1, 1999, only the following catcher/processors shall be eligible to harvest the directed fishing allowance under section 206(b)(2) pursuant to a federal fishing permit:

(1) AMERICAN DYNASTY (United States official number 951307);

(2) KATIE ANN (United States official number 518441);

(3) AMERICAN TRIUMPH (United States official number 646737);

(4) NORTHERN EAGLE (United States official number 506694);

(5) NORTHERN HAWK (United States official number 643771);

(6) NORTHERN JAEGER (United States official number 521069);

(7) OCEAN ROVER (United States official number 552100);

(8) ALASKA OCEAN (United States official number 637856);

(9) ENDURANCE (United States official number 592206);

(10) AMERICAN ENTERPRISE (United States official number 594803);

(11) ISLAND ENTERPRISE (United States official number 610290);

(12) KODIAK ENTERPRISE (United States official number 579450);

(13) SEATTLE ENTERPRISE (United States official number 904767);

(14) US ENTERPRISE (United States official number 921112);

(15) ARCTIC STORM (United States official number 903511);

(16) ARCTIC FJORD (United States official number 940866);

(17) NORTHERN GLACIER (United States official number 663457);

(18) PACIFIC GLACIER (United States official number 933627);

(19) HIGHLAND LIGHT (United States official number 577044);

(20) STARBOUND (United States official number 944658); and

(21) any catcher/processor not listed in this subsection and determined by the Secretary to have harvested more than 2,000 metric tons of the pollock in the 1997 directed pollock fishery and determined to be eligible to harvest pollock in the directed pollock fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary, except that catcher/processors eligible under this paragraph shall be prohibited from harvesting in the aggregate a total of more than one-half (0.5) of a percent of the pollock apportioned for the directed pollock fishery under section 206(b)(2).

Notwithstanding section 213(a), failure to satisfy the requirements of section 4(a) of the Commercial Fishing Industry Vessel Anti-Reflagging Act of 1987 (Public Law 100-239; 46 U.S.C. 12108 note) shall not make a catcher/processor listed under this subsection ineligible for a fishery endorsement.

(f) SHORESIDE PROCESSORS. (1) Effective January 1, 2000 and except as provided in paragraph (2), the catcher vessels eligible under subsection (a) may deliver pollock harvested from the directed fishing allowance under section 206(b)(1) only to –

(A) shoreside processors (including vessels in a single geographic location in Alaska State waters) determined by the Secretary to have processed more than 2,000 metric tons round-weight of pollock in the inshore component of the directed pollock fishery during each of 1996 and 1997; and

(B) shoreside processors determined by the Secretary to have processed pollock in the inshore component of the directed pollock fishery in 1996 and 1997, but to have processed less than 2,000 metric tons round-weight of such pollock in each year, except that effective January 1, 2000, each such shoreside processor may not process more than 2,000 metric tons round-weight from such directed fishing allowance in any year;

(2) Upon recommendation by the North Pacific Council, the Secretary may approve measures to allow catcher vessels eligible under subsection (a) to deliver pollock harvested from the directed fishing allowance under section 206(b)(1) to shoreside processors not eligible under paragraph (1) if the total allowable catch for pollock in the Bering Sea and Aleutian Islands Management Area increases by more than 10 percent above the total allowable catch in such fishery in 1997, or in the event of the actual total loss or constructive total loss of a shoreside processor eligible under paragraph (1)(A).

(g) REPLACEMENT VESSELS. In the event of the actual total loss or constructive total loss of a vessel eligible under subsections (a), (b), (c), (d), or (e), the owner of such vessel may replace such vessel with a vessel which shall be eligible in the same manner under that subsection as the eligible vessel, provided that –

(1) such loss was caused by an act of God, an act of war, a collision, an act or omission of a party other than the owner or agent of the vessel, or any other event not caused by the willful misconduct of the owner or agent;

(2) the replacement vessel was built in the United States and if ever rebuilt, was rebuilt in the United States;

(3) the fishery endorsement for the replacement vessel is issued within 36 months of the end of the last year in which the eligible vessel harvested or processed pollock in the directed pollock fishery;

(4) if the eligible vessel is greater than 165 feet in registered length, of more than 750 gross registered tons (as measured under chapter 145 of title 46) or 1,900 gross registered tons as measured under chapter 143 of that title, or has engines capable of producing more than 3,000 shaft horsepower, the replacement vessel is of the same or lesser registered length, gross registered tons, and shaft horsepower;

(5) if the eligible vessel is less than 165 feet in registered length, of fewer than 750 gross registered tons, and has engines incapable of producing more than 3,000 shaft horsepower, the replacement vessel is less than each of such thresholds and does not exceed by more than 10 percent the registered length, gross registered tons or shaft horsepower of the eligible vessel; and

(6) the replacement vessel otherwise qualifies under federal law for a fishery endorsement, including under section 12102(c) of title 46, United States Code, as amended by this Act.

(h) ELIGIBILITY DURING IMPLEMENTATION. In the event the Secretary is unable to make a final determination about the eligibility of a vessel under subsection (b)(8) or subsection (e)(21) before January 1, 1999, or a vessel or shoreside processor under subsection (a), subsection (c)(21), or subsection (f) before January 1, 2000, such vessel or shoreside processor, upon the filing of an application for eligibility, shall be eligible to participate in the directed pollock fishery pending final determination by the Secretary with respect to such vessel or shoreside processor.

(i) ELIGIBILITY NOT A RIGHT. Eligibility under this section shall not be construed –

(1) to confer any right of compensation, monetary or otherwise, to the owner of any catcher vessel, catcher/processor, mothership, or shoreside processor if such eligibility is revoked or limited in any way, including through the revocation or limitation of a fishery endorsement or any federal permit or license;

(2) to create any right, title, or interest in or to any fish in any fishery; or

(3) to waive any provision of law otherwise applicable to such catcher vessel, catcher/processor, mothership, or shoreside processor.

SEC. 209. LIST OF INELIGIBLE VESSELS.

Effective December 31, 1998, the following vessels shall be permanently ineligible for fishery endorsements, and any claims (including relating to catch history) associated with such vessels that could qualify any owners of such vessels for any present or future limited access system permit in any fishery within the exclusive economic zone of the United States (including a vessel moratorium permit or license limitation program permit in fisheries under the authority of the North Pacific Council) are hereby extinguished:

(1) AMERICAN EMPRESS (United States official number 942347);

(2) PACIFIC SCOUT (United States official number 934772);

(3) PACIFIC EXPLOYER (United States official number 942592);

(4) PACIFIC NAVIGATOR (United States official number 592204);

(5) VICTORIA ANN (United States official number 592207);

(6) ELIZABETH ANN (United States official number 534721);

(7) CHRISTINA ANN (United States official number 653045);

(8) REBECCA ANN (United States official number 592205);

(9) BROWNS POINT (United States official number 587440).

SEC. 210. FISHERY COOPERATIVE LIMITATIONS.

(a) PUBLIC NOTICE. (1) Any contract implementing a fishery cooperative under section 1 of the Act of June 25, 1934 (15 U.S.C. 521) in the directed pollock fishery and any material modifications to any such contract shall be filed not less than 30 days prior to the start of fishing under the contract with the North Pacific Council and with the Secretary, together with a copy of a letter from a party to the contract requesting a business review letter on the fishery cooperative from the Department of Justice and any response to such request. Notwithstanding section 402 of the Magnuson-Stevens Act (16 U.S.C. 1881a) or any other provision of law, but taking into account the interest of parties to any such contract in protecting the confidentiality of proprietary information, the North Pacific Council and Secretary shall –

(A) make available to the public such information about the contract, contract modifications, or fishery cooperative the North Pacific Council and Secretary deem appropriate, which at a minimum shall include a list of the parties to the contract, a list of the vessels involved, and the amount of pollock and other fish to be harvested by each party to such contract; and

(B) make available to the public in such manner as the North Pacific Council and Secretary deem appropriate information about the harvest by vessels under a fishery cooperative of all species (including by catch) in the directed pollock fishery on a vessel-by-vessel basis.

(b) CATCHER VESSELS ONSHORE

(1) CATCHER VESSEL COOPERATIVES. Effective January 1, 2000, upon the filing of a contract implementing a fishery cooperative under subsection (a) which –

(A) is signed by the owners of 80 percent or more of the qualified catcher vessels that delivered pollock for processing by a shoreside processor in the directed pollock fishery in the year prior to the year in which the fishery cooperative will be in effect; and

(B) specifies, except as provided in paragraph (6), that such catcher vessels will deliver pollock in the directed pollock fishery only to such shoreside processor during the year in which the fishery cooperative will be in effect and that such shoreside processor has agreed to process such pollock,

the Secretary shall allow only such catcher vessels (and catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) to harvest the aggregate percentage of the directed fishing allowance under section 206(b)(1) in the year in which the fishery cooperative will be in effect that is equivalent to the aggregate total amount of pollock harvested by such catcher vessels (and by such catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) in the directed pollock fishery for processing by the inshore component during 1995, 1996, and 1997 relative to the aggregate total amount of pollock harvested in the directed pollock fishery for processing by the inshore component during such years and shall prevent such catcher vessels (and catcher vessels whose owners voluntarily participate pursuant to paragraph (2)) from harvesting in aggregate in excess of such percentage of such directed fishing allowance.

(2) VOLUNTARY PARTICIPATION. Any contract implementing a fishery cooperative under paragraph (1) must allow the owners of other qualified catcher vessels to enter into such contract after it is filed and before the calender year in which fishing will begin under the same terms and conditions as the owners of the qualified catcher vessels who entered into such contract upon filing.

(3) QUALIFIED CATCHER VESSEL. For the purposes of this subsection, a catcher vessel shall be considered a qualified catcher vessel if, during the year prior to the year in which the fishery cooperative will be in effect, it delivered more pollock to the shoreside processor to which it will deliver pollock under the fishery cooperative in paragraph (1) than to any other shoreside processor.

(4) CONSIDERATION OF CERTAIN VESSELS. Any contract implementing a fishery cooperative under paragraph (1) which has been entered into by the owner of a qualified catcher vessel eligible under section 208(a) that harvested pollock for processing by catcher/processors or motherships in the directed pollock fishery during 1995, 1996, and 1997 shall, to the extent practicable, provide fair and equitable terms and conditions for the owner of such qualified catcher vessel.

(5) OPEN ACCESS. A catcher vessel eligible under section 208(a) the catch history of which has not been attributed to a fishery cooperative under paragraph (1) may be used to deliver pollock harvested by such vessel from the directed fishing allowance under section 206(b)(1) (other than pollock reserved under paragraph (1) for a fishery cooperative) to any of the shoreside processors eligible under section 208(f). A catcher vessel eligible under section 208(a) the catch history of which has been attributed to a fishery cooperative under paragraph (1) during any calendar year may not harvest any pollock apportioned under section 206(b)(1) in such calendar year other than the pollock reserved under paragraph (1) for such fishery cooperative.

(6) TRANSFER OF COOPERATIVE HARVEST. A contract implementing a fishery cooperative under paragraph (1) may, notwithstanding the other provisions of this subsection, provide for up to 10 percent of the pollock harvested under such cooperative to be processed by a shoreside processor eligible under section 208(f) other than the shoreside processor to which pollock will be delivered under paragraph (1).

(c) CATCHER VESSELS TO CATCHER/PROCESSORS. Effective January 1, 1999, not less than 8.5 percent of the directed fishing allowance under section 206(b)(2) shall be available for harvest only by the catcher vessels eligible under section 208(b). The owners of such catcher vessels may participate in a fishery cooperative with the owners of the catcher/ processors eligible under paragraphs (1) through (20) of the section 208(e). The owners of such catcher vessels may participate in a fishery cooperative that will be in effect during 1999 only if the contract implementing such cooperative establishes penalties to prevent such vessels from exceeding in 1999 the traditional levels harvested by such vessels in all other fisheries in the exclusive economic zone of the United States.

(d) CATCHER VESSELS TO MOTHERSHIPS

(1) PROCESSING. Effective January 1, 2000, the authority in section 1 of the Act of June 25, 1934 (48 STAT. 1213 and 1214; 15 U.S.C. 521 et seq.) shall extend to processing by motherships eligible under section 208(d) solely for the purposes of forming or participating in a fishery cooperative in the directed pollock fishery upon the filing of a contract to implement a fishery cooperative under subsection (a) which has been entered into by the owners of 80 percent or more of the catcher vessels eligible under section 208(c) for the duration of such contract, provided that such owners agree to the terms of the fishery cooperative involving processing by the motherships.

(2) VOLUNTARY PARTICIPATION. Any contract implementing a fishery cooperative described in paragraph (1) must allow the owners of any other catcher vessels eligible under section 208(c) to enter such contract after it is filed and before the calendar year in which fishing will begin under the same terms and conditions as the owners of the catcher vessels who entered into such contract upon filing.

(e) EXCESSIVE SHARES.

(1) HARVESTING. No particular individual, corporation, or other entity may harvest, through a fishery cooperative or otherwise, a total of more than 17.5 percent of the pollock available to be harvested in the directed pollock fishery.

(2) PROCESSING. Under the authority of section 301(a)(4) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(4)), the North Pacific Council is directed to recommend for approval by the Secretary conservation and management measures to prevent any particular individual or entity from processing an excessive share of the pollock available to be harvested in the directed pollock fishery. In the event the North Pacific Council recommends and the Secretary approves an excessive processing share that is lower than 17.5 percent, any individual or entity that previously processed a percentage greater than such share shall be allowed to continue to process such percentage, except that their percentage may not exceed 17.5 percent (excluding pollock processed by catcher/processors that was harvested in the directed pollock fishery by catcher vessels eligible under section 208(b)) and shall be reduced if their percentage decreases, until their percentage is below such share. In recommending the excessive processing share, the North Pacific Council shall consider the need of catcher vessels in the directed pollock fishery to have competitive buyers for the pollock harvested by such vessels.

(3) REVIEW BY MARITIME ADMINISTRATION. At the request of the North Pacific Council or the Secretary, any individual or entity believed by such Council or the Secretary to have exceeded the percentage in either paragraph (1) or (2) shall submit such information to the Administrator of the Maritime Administration as the Administrator deems appropriate to allow the Administrator to determine whether such individual or entity has exceeded either such percentage. The Administrator shall make a finding as soon as practicable upon such request and shall submit such finding to the North Pacific Council and the Secretary. For the purposes of this subsection, any entity in which 10 percent or more of the interest is owned or controlled by another individual or entity shall be considered to be the same entity as the other individual or entity.

(f) LANDING TAX JURISDICTION. Any contract filed under subsection (a) shall include a contract clause under which the parties to the contract agree to make payments to the State of Alaska for any pollock harvested in the directed pollock fishery which is not landed in the State of Alaska, in amounts which would otherwise accrue had the pollock been landed in the State of Alaska subject to any landing taxes established under Alaska law. Failure to include such a contract clause or for such amounts to be paid shall result in a revocation of the authority to form fishery cooperatives under section 1 of the Act of June 25, 1934 (15 U.S.C. 521 et seq.).

(g) PENALTIES. The violation of any of the requirements of this subtitle or any regulation or permit issued pursuant to this subtitle shall be considered the commission of an act prohibited by section 307 of the Magnuson-Stevens Act (16 U.S.C. 1857), and sections 308, 309, 310, and 311 of such Act (16 U.S.C. 1858, 1859, 1860, and 1861) shall apply to any such violation in the same manner as to the commission of an act prohibited by section 307 of such Act (16 U.S.C. 1857). In addition to the civil penalties and permit sanctions applicable to prohibited acts under section 308 of such Act (16 U.S.C. 1858), any person who is found by the Secretary, after notice and an opportunity for a hearing in accordance with section 554 of title 5, United States Code, to have violated a requirement of this section shall be subject to the forfeiture to the Secretary of Commerce of any fish harvested or processed during the commission of such act.

SEC. 211. PROTECTIONS FOR OTHER FISHERIES; CONSERVATION MEASURES.

(a) GENERAL. The North Pacific Council shall recommend for approval by the Secretary such conservation and management measures as it determines necessary to protect other fisheries under its jurisdiction and the participants in those fisheries, including processors, from adverse impacts caused by this Act or fishery cooperatives in the directed pollock fishery.

(b) CATCHER/PROCESSOR RESTRICTIONS.

(1) GENERAL. The restrictions in this subsection shall take effect on January 1, 1999 and shall remain in effect thereafter except that they may be superseded (with the exception of paragraph (4)) by conservation and management measures recommended after the date of the enactment of this Act by the North Pacific Council and approved by the Secretary in accordance with the Magnuson-Stevens Act.

(2) BERING SEA FISHING. The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from, in the aggregate –

(A) exceeding the percentage of the harvest available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total harvest by such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997;

(B) exceeding the percentage of the prohibited species available in the offshore component of any Bering Sea and Aleutian Islands groundfish fishery (other than the pollock fishery) that is equivalent to the total of the prohibited species harvested by such catcher/processors and the catcher/processors listed in section 209 in the fishery in 1995, 1996, and 1997 relative to the total amount of prohibited species available to be harvested by the offshore component in the fishery in 1995, 1996, and 1997.

(C) fishing for Atka mackerel in the eastern area of the Bering Sea and Aleutian Islands and from exceeding the following percentages of the directed harvest available in the Bering Sea and Aleutian Islands Atka mackerel fishery –

(i) 11.5 percent in the central area; and

(ii) 20 percent in the western area.

(3) BERING SEA PROCESSING. The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from –

(A) processing any of the directed fishing allowances under paragraphs (1) or (3) of section 206(b); and

(B) processing any species of crab harvested in the Bering Sea and Aleutian Islands Management Area.

(4) GULF OF ALASKA. The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) are hereby prohibited from –

(A) harvesting any fish in the Gulf of Alaska;

(B) processing any groundfish harvested from the portion of the exclusive economic zone off Alaska known as area 630 under the fishery management plan for Gulf of Alaska groundfish; or

(C) processing any pollock in the Gulf of Alaska (other than as by catch in non-pollock groundfish fisheries) or processing, in the aggregate, a total of more than 10 percent of the cod harvested from areas 610, 620, and 640 of the Gulf of Alaska under the fishery management plan for Gulf of Alaska groundfish.

(5) FISHERIES OTHER THAN NORTH PACIFIC. The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) and motherships eligible under section 208(d) are hereby prohibited from harvesting fish in any fishery under the authority of any regional fishery management council established under section 302(a) of the Magnuson-Stevens Act (16 U.S.C. 1852(a)) other than the North Pacific Council, except for the Pacific whiting fishery, and from processing fish in any fishery under the authority of any such regional fishery management council other than the North Pacific Council, except in the Pacific whiting fishery, unless the catcher/processor or mothership is authorized to harvest or process fish under a fishery management plan recommended by the regional fishery management council of jurisdiction and approved by the Secretary.

(6) OBSERVERS AND SCALES. The catcher/processors eligible under paragraphs (1) through (20) of section 208(e) shall –

(A) have two observers onboard at all times while groundfish is being harvested, processed, or received from another vessel in any fishery under the authority of the North Pacific Council; and

(B) weight its catch on a scale onboard approved by the National Marine Fisheries Service while harvesting groundfish in fisheries under the authority of the North Pacific Council.

This paragraph shall take effect on January 1, 1999 for catcher/processors eligible under paragraphs (1) through (20) of section 208(e) that will harvest pollock allocated under section 206(a) in 1999, and shall take effect on January 1, 2000 for all other catcher/processors eligible under such paragraphs of section 208(e).

(c) CATCHER VESSEL AND SHORESIDE PROCESSOR RESTRICTIONS.

(1) REQUIRED COUNCIL RECOMMENDATIONS. By not later than July 1, 1999, the North Pacific Council shall recommend for approval by the Secretary conservation and management measures to –

(A) prevent the catcher vessels eligible under subsections (a), (b), and (c) of section 208 from exceeding in the aggregate the traditional harvest levels of such vessels in other fisheries under the authority of the North Pacific Council as a result of fishery cooperatives in the directed pollock fisheries; and

(B) protect processors not eligible to participate in the directed pollock fishery from adverse effects as a result of this Act or fishery cooperatives in the directed pollock fishery.

If the North Pacific Council does not recommend such conservation and management measures by such date, or if the Secretary determines that such conservation and management measures recommended by the North Pacific Council are not adequate to fulfill the purposes of this paragraph, the Secretary may by regulation restrict or change the authority in section 210(b) to the extent the Secretary deems appropriate, including by preventing fishery cooperatives from being formed pursuant to such section and by providing greater flexibility with respect to the shoreside processor or shoreside processors to which catcher vessels in a fishery cooperative under section 210(b) may deliver pollock.

(2) BERING SEA CRAB AND GROUNDFISH.

(A) Effective January 1, 2000, the owners of the motherships eligible under section 208(d) and the shoreside processors eligible under section 208(f) that receive pollock from the directed pollock fishery under a fishery cooperative are hereby prohibited from processing, in the aggregate for each calendar year, more than the percentage of the total catch of each species of crab in directed fisheries under the jurisdiction of the North Pacific Council than facilities operated by such owners processed of each such species in the aggregate, on average, in 1995, 1996, and 1997. For the purposes of this subparagraph, the term facilities means any processing plant, catcher/processor, mothership, floating processor, or any other operation that processes fish. Any entity in which 10 percent or more of the interest is owned or controlled by another individual or entity shall be considered to be the same entity as the other individual or entity for the purposes of this subparagraph.

(B) Under the authority of section 301(a)(4) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(4)), the North Pacific Council is directed to recommend for approval by the Secretary conservation and management measures to prevent any particular individual or entity from harvesting or processing an excessive share of crab or of groundfish in fisheries in the Bering Sea and Aleutian Islands Management Area.

(C) The catcher vessels eligible under section 208(b) are hereby prohibited from participating in a directed fishery for any species of crab in the Bering Sea and Aleutian Islands Management Area unless the catcher vessel harvested crab in the directed fishery for that species of crab in such Area during 1997 and is eligible to harvest such crab in such directed fishery under the license limitation program recommended by the North Pacific Council and approved by the Secretary. The North Pacific Council is directed to recommend measures for approval by the Secretary to eliminate latent licenses under such program, and nothing in this subparagraph shall preclude the Council from recommending measures more restrictive than under this paragraph.

(3) FISHERIES OTHER THAN NORTH PACIFIC.

(A) By not later than July 1, 2000, the Pacific Fishery Management Council established under section 302(a)(1)(F) of the Magnuson-Stevens Act (16 U.S.C. 1852 (a)(1)(F)) shall recommended for approval by the Secretary conservation and management measures to protect fisheries under its jurisdiction and the participants in those fisheries from adverse impacts caused by this Act or by any fishery cooperatives in the directed pollock fishery.

(B) If the Pacific Council does not recommend such conservation and management measures by such date, or if the Secretary determines that such conservation and management measures recommended by the Pacific Council are not adequate to fulfill the purposes of this paragraph, the Secretary may by regulation implement adequate measures including, but not limited to, restrictions on vessels which harvest pollock under a fishery cooperative which will prevent such vessels from

harvesting Pacific groundfish, and restrictions on the number of processors eligible to process Pacific groundfish.

(d) BYCATCH INFORMATION. Notwithstanding section 402 of the Magnuson-Stevens Act (16 U.S.C. 1881a), the North Pacific Council may recommend and the Secretary may approve, under such terms and conditions as the North Pacific Council and Secretary deem appropriate, the public disclosure of any information from the groundfish fisheries under the authority of such Council that would be beneficial in the implementation of section 301(a)(9) or section 303(a)(11) of the Magnuson-Stevens Act (16 U.S.C. 1851(a)(9) and 1853(a)(11)).

(e) COMMUNITY DEVELOPMENT LOAN PROGRAM. Under the authority of title XI of the Merchant Marine Act, 1936 (46 U.S.C. App. 1271 et seq.), and subject to the availability of appropriations, the Secretary is authorized to provide direct loan obligations to communities eligible to participate in the western Alaska community development quota program established under section 304(i) of the Magnuson-Stevens Act (16 U.S.C. 1855(i)) for the purposes of purchasing all or part of an ownership interest in vessels and shoreside processors eligible under subsections (a), (b), (c), (d), (e), or (f) of section 208. Notwithstanding the eligibility criteria in section 208(a) and section 208(c), the LISA MARIE (United States official number 1038717) shall be eligible under such sections in the same manner as other vessels eligible under such sections.

SEC. 212. RESTRICTION ON FEDERAL LOANS.

Section 302(b) of the Fisheries Financing Act (46 U.S.C. 1274 note) is amended –

(1) by inserting "(1)" before "Until October 1, 2001" ; and

(2) by inserting at the end the following new paragraph:

"(2) No loans may be provided or guaranteed by the Federal Government for the construction or rebuilding of a vessel intended for use as a fishing vessel (as defined in section 2101 of title 46, United States Code), if such vessel will be greater than 165 feet in registered length, of more than 750 gross registered tons (as measured under chapter 145 of title 46) or 1,900 gross registered tons as measured under chapter 143 of that title, or have an engine or engines capable of producing a total of more than 3,000 shaft horsepower, after such construction or rebuilding is completed. This prohibition shall not apply to vessels to be used in the menhaden fishery or in tuna purse seine fisheries outside the exclusive economic zone of the United States or the area of the South Pacific Regional Fisheries Treaty.".

SEC. 213. DURATION.

(a) GENERAL. Except as otherwise provided in this title, the provisions of this title shall take effect upon the date of the enactment of this Act. There are authorized to be appropriated $6,700,000 per year to carry out the provisions of this Act through fiscal year 2004.

(b) EXISTING AUTHORITY. Except for the measures required by this subtitle, nothing in this subtitle shall be construed to limit the authority of the North Pacific Council or the Secretary under the Magnuson-Stevens Act.

(c) CHANGES TO FISHERY COOPERATIVE LIMITATIONS AND POLLOCK CDQ ALLOCATION. The North Pacific Council may recommend and the Secretary may approve conservation and management measures in accordance with the Magnuson-Stevens Act –

(1) that supersede the provisions of this subtitle, except for section 206 and 208, for conservation purposes or to mitigate adverse effects in fisheries or on owners of fewer than three vessels in the directed pollock fishery caused by this title or fishery cooperatives in the directed pollock fishery,

provided such measures take into account all factors affecting the fisheries and are imposed fairly and equitably to the extent practicable among and within the sectors in the directed pollock fishery;

(2) that supersede the allocation in section 206(a) for any of the years 2002, 2003, and 2004, upon the finding by such Council that the western Alaska community development quota program for pollock has been adversely affected by the amendments in this subtitle; or

(3) that supersede the criteria required in paragraph (1) of section 210(b) to be used by the Secretary to set the percentage allowed to be harvested by catcher vessels pursuant to a fishery cooperative under such paragraph.

(d) REPORT TO CONGRESS. Not later than October 1, 2000, the North Pacific Council shall submit a report to the Secretary and to Congress on the implementation and effects of this Act, including the effects on fishery conservation and management, on bycatch levels, on fishing communities, on business and employment practices of participants in any fishery cooperatives, on the western Alaska community development quota program, on any fisheries outside of the authority of the North Pacific Council, and such other matters as the North Pacific Council deems appropriate.

(e) REPORT ON FILLET PRODUCTION. Not later than June 1, 2000, the General Accounting Office shall submit a report to the North Pacific Council, the Secretary, and the Congress on whether this Act has negatively affected the market for fillets and fillet blocks, including through the reduction in the supply of such fillets and fillet blocks. If the report determines that such market has been negatively affected, the North Pacific Council shall recommend measures for the Secretary's approval to mitigate any negative effects.

(f) SEVERABILITY. If any provision of this title, an amendment made by this title, or the application of such provision or amendment to any person or circumstance is held to be unconstitutional, the remainder of this title, the amendments made by this title, and the application of the provisions of such to any person or circumstance shall not be affected thereby.

(g) INTERNATIONAL AGREEMENTS. In the event that any provision of section 12102(c) or section 31322(a) of title 46, United States Code, as amended by this Act, is determined to be inconsistent with an existing international agreement relating to foreign investment to which the United States is a party with respect to the owner or mortgagee on October 1, 2001 of a vessel with a fishery endorsement, such provision shall not apply to that owner or mortgagee with respect to such vessel to the extent of any such inconsistency. The provisions of section 12102(c) and section 31322(a) of title 46, United States Code, as amended by this Act, shall apply to all subsequent owners and mortgagees of such vessel, and shall apply, notwithstanding the preceding sentence, to the owner on October 1, 2001 of such vessel if any ownership interest in that owner is transferred to or otherwise acquired by a foreign individual or entity after such date.

Appendix D Life History Features and Habitat Requirements of FMP Species

This appendix describes habitat requirements and life histories of the groundfish species managed by this FMP. Each species or species group is described individually, however, two summary tables that denote habitat associations (Table D-1), biological associations (Table D-2), and reproductive traits (Table D-3) are also provided.

In each individual section, a species-specific tables summarizes habitat. The following abbreviations are used in these habitat tables to specify location, position in the water column, bottom type, and other oceanographic features.

Location

BCH	=	beach (intertidal)
ICS	=	inner continental shelf (1-50 m)
MCS	=	middle continental shelf (50-100 m)
OCS	=	outer continental shelf (100-200 m)
USP	=	upper slope (200-1000 m)
LSP	=	lower slope (1000-3000 m)
BSN	=	basin (>3000 m)
BAY	=	nearshore bays, with depth if appropriate (e.g., fjords)
IP	=	island passes (areas of high current), with depth if appropriate

Water column

D	=	demersal (found on bottom)
SD/SP	=	semi-demersal or semi-pelagic, if slightly greater or less than 50% on or off bottom
P	=	pelagic (found off bottom, not necessarily associated with a particular bottom type)
N	=	neustonic (found near surface)

General

U	=	unknown
NA	=	not applicable

Bottom Type

M	=	mud
S	=	sand
MS	=	muddy sand
R	=	rock
SM	=	sandy mud
CB	=	cobble
G	=	gravel
C	=	coral
K	=	kelp
SAV	=	subaquatic vegetation (e.g., eelgrass, not kelp)

Oceanographic Features

UP	=	upwelling
G	=	gyres
F	=	fronts
CL	=	thermo- or pycnocline
E	=	edges

Table D.1a Summary of habitat associations for BSAI groundfish (pollock, Pacific cod, sablefish, flatfish).

| | | Life Stage/Activity (A = Adult, J = Juvenile, LJ = Late Juvenile, EJ = Early Juvenile, L = Larvae, E = Eggs) | | |

Table D.1b Summary of habitat associations for BSAI groundfish (rockfish, Atka mackerel, squid, 'other species').

		Life Stage/Activity (A = Adult, J = Juvenile, L = Larvae, E = Eggs)																																				
		Pacific ocean perch			Shortraker & rougheye rockfish			Northern rockfish			Dusky rockfish			Yelloweye rockfish			Thornyhead rockfish				Atka mackerel				Squid			Sculpins				Sharks			Skates			Octopus		
		A	J	L	A	J	L	A	J	L	A	J	L	A	L	E	A	J	L	E	A	J	L	E	A	L	E	A	J	L	E	A	J	L	A	J	L	A	J	E
Location	beach (intertidal)																											X	X		X									
	inner Shelf (1-50m)		X	X					X			X									X			X	X	X		X	X	X	X	X	X					X	X	X
	middle Shelf (50-100m)		X	X		X			X			X		X	X		X	X			X				X	X		X	X	X	X	X	X		X	X	X	X	X	X
	outer Shelf (100-200m)	X	X	X	X	X		X	X		X	X		X	X		X	X			X				X	X		X	X	X	X	X	X		X	X	X	X	X	X
	upper Slope (200-1000m)	X	X	X	X			X			X			X	X		X	X							X	X	X	X		X		X	X		X	X	X	X	X	X
	lower Slope (>1000m)			X													X								X	X	X													
	basin (>3000m)			X																					X	X														
	bay/estuarine													X	X																									
	island pass													X	X						X			X																
	not known						X			X			X			X			X	X		X	X											X						
Substrate	mud/clay/silt				X												X	X									X	X	X			X			X			X		
	sand/granule				X												X	X									X	X	X			X			X			X		
	gravel	X	X		X						X	X		X	X	X	X	X			X			X				X	X		X	X			X			X		X
	pebble	X	X		X									X	X		X	X			X			X				X			X	X								X
	cobble	X	X		X			X	X		X	X		X	X	X	X	X			X			X				X			X									X
	boulder		X		X			X	X		X	X		X	X		X	X										X												
	bedrock				X						X			X	X	X	X	X																						
	not applicable			X			X			X			X													X				X		X	X	X						
vegetation	kelp forest																				X			X																
	sea grasses																																							
pelagic domain	near surface																						X			X				X										
	pelagic		X	X						X			X						X	X						X				X		X	X							
	semi-demersal/ semi-pelagic	X	X		X			X	X		X										X				X														X	
	demersal	X												X	X	X	X	X						X			X	X	X		X	X	X		X	X	X	X		X
	not known					X	X					X										X																		
oceanography	upwelling areas	X	X	X																					X	X														
	gyres																																							
	thermo/ pycnocline																																							
	fronts																				X				X	X														
	edges (ice, bathymetric)																				X																			

Table D.1c Summary of habitat associations for BSAI groundfish (forage fish species).

		Life Stage/Activity (A = Adult, J = Juvenile, LJ = Late Juvenile, EJ = Early Juvenile, L = Larvae, E = Eggs)																															
		Eulachon				Capelin				Sand lance				Myctophids & Bathylagids				Sand fish				Euphausiids				Pholids and Stichaeids				Gonostomatids			
		A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E
Location	beach (intertidal)					X			X												X					X	X						
	inner Shelf (1-50m)			X		X	X	X		X	X	X	X					X	X														
	middle Shelf (50-100m)	X	X			X	X	X		X	X																						
	outer Shelf (100-200m)	X	X			X																X	X										
	upper Slope (200-1000m)	X	X											X	X							X	X							X			
	lower Slope (>1000m)													X	X							X	X							X			
	basin (>3000m)													X	X							X	X							X			
	bay/estuarine																																
	island pass																																
	not known															X	X			X				X	X			X	X		X	X	X
Substrate	mud/clay/silt				X					X	X							X	X							X	X						
	sand/granule				X	X			X	X	X		X					X	X														
	gravel				X								X																				
	pebble																																
	cobble					X			X												X												
	boulder																				X												
	bedrock																																
	not applicable	X	X	X		X	X	X				X		X	X							X	X							X			
vegetation	kelp forest																									X	X						
	sea grasses																									X	X						
pelagic domain	near surface							X				X												X	X								
	pelagic	X	X	X		X	X					X										X	X	X						X			
	semi-demersal/ semi-pelagic									X	X			X	X																		
	demersal				X				X				X					X	X		X												
	not known															X	X			X								X	X		X	X	X
oceanography	upwelling areas																					X	X										
	gyres																																
	thermo/ pycnocline																																
	fronts					X	X																										
	edges (ice, bathymetric)					X	X															X	X										

Table D.2a Summary of biological associations for BSAI groundfish (pollock, Pacific cod, sablefish, flatfish).

| | | Life Stage/Activity (A = Adult, J = Juvenile, LJ = Late Juvenile, EJ = Early Juvenile, L = Larvae, E = Eggs) | | |

Table D.2b Summary of biological associations for BSAI groundfish (rockfish, Atka mackerel, squid, 'other species').

		Life Stage/Activity (A = Adult, J = Juvenile, L = Larvae, E = Eggs)																																				
		Pacific ocean perch			Shortraker & rougheye rockfish			Northern rockfish			Dusky rockfish			Yelloweye rockfish			Thornyhead rockfish				Atka mackerel				Squid			Sculpins				Sharks				Skates			Octopus		
		A	J	L	A	J	L	A	J	L	A	J	L	A	L	E	A	J	L	E	A	J	L	E	A	L	E	A	J	L	E	A	J	L	E	A	J	E	A	J	E
feeding type	carnivore	X	X		X	X		X			X			X	X		X	X			X	X	X		X			X	X			X	X			X	X		X		
	herbivore																																								
	omnivore																																								
	planktivore			X			X									X								X		X														X	
	detritivore																																								
	not known								X	X		X	X						X	X							X			X	X			X	X						
movements	drift with ocean conditions																																								
	reside in nursery areas																																								
	alongshore migrations																																								
	inshore/ offshore migrations	X																			X				X																
	not known		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
social behavior	solitary																																								
	schooling	X						X						X	X						X																				
	shoaling																																								
	not known		X	X	X	X	X		X	X	X	X	X			X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
longevity of life stage	1 day																																								
	1-30 days																							X																	
	1-12 months			X												X			X				X			X	X														
	1-5 years																				X	X			X														X		
	5-20 years		X						X						X																										
	20-50 years										X																														
	>50 years	X			X			X						X																		X									
	not known					X	X			X		X	X				X	X		X								X	X	X	X		X	X	X	X	X	X		X	X

Table D.2c Summary of biological associations for BSAI groundfish (forage fish species).

		Life Stage/Activity (A = Adult, J = Juvenile, LJ = Late Juvenile, EJ = Early Juvenile, L = Larvae, E = Eggs)																															
		Eulachon				Capelin				Sand lance				Myctophids & Bathylagids				Sand fish				Euphausiids				Pholids and Stichaeids				Gonostomatids			
		A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E	A	J	L	E
feeding type	carnivore																	X															
	herbivore																																
	omnivore									X	X															X	X						
	planktivore	X	X	X		X	X	X						X								X	X	X									
	detritivore																																
	not known											X	X		X	X	X		X	X	X							X	X	X	X	X	X
movements	drift with ocean conditions			X				X														X	X	X									
	reside in nursery areas																																
	alongshore migrations																																
	inshore/ offshore migrations	X				X	X																										
	not known		X							X	X	X	X	X	X	X	X	X	X	X	X									X	X	X	X
social behavior	solitary																									X							
	schooling	X	X			X	X																										
	shoaling																					X	X										
	not known			X						X	X	X	X	X	X	X	X	X	X	X	X						X	X	X	X	X	X	X
longevity of life stage	1 day																																
	1-30 days				X				X																								
	1-12 months																																
	1-5 years	X				X				X																							
	5-20 years																					X				X							
	20-50 years																																
	>50 years																																
	not known		X	X			X	X			X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X	X

Table D.2 Summary of reproductive traits for BSAI groundfish.

	Age at Maturity (years unless indicated)				Fertilization/Egg Development					Spawning behavior						Spawning Season								
	Female		Male																					
	50%	100%	50%	100%	external	internal	oviparous	ovoviviparous	viviparous	batch spawner	broadcast spawner	egg case deposition	nest builder	egg/young guarder	egg/young bearer	early spring	late spring	early summer	late summer	early fall	late fall	early winter	late winter	not known
Walleye pollock	4		4		X						X					X								
Pacific cod	5		5		X					X						X						X	X	
Sablefish	65cm		57cm		X						X					X	X							
Yellowfin sole	10.5				X						X						X	X	X					
Greenland turbot	5-10				X						X									X	X	X	X	
Arrowtooth flounder	5		4		X																			X
Rock sole	9				X					X						X							X	
Flathead sole	6-7				X											X								
Alaska plaice	24cm				X																			
Pacific ocean perch	10.5					X			X												X	X		
Northern rockfish	12.8					X			X								X	X						
Shortraker and rougheye rockfish	20		20			X			X								X	X						
Thornyhead rockfish	12									X						X							X	
Dusky rockfish						X			X								X	X						
Atka mackerel	3		3		X							X	X					X	X					
Squid						X											X	X						
Sculpins					X	X						X	X									X	X	
Sharks						X		X																
Skates						X	X				X													X
Octopus						X																		X
Eulachon	3	5	3	5	X		X			X						X	X							
Capelin	2	4	2	4	X		X			X						X	X	X	X	X				
Sand Lance	2																							X
Myctophids & Bathylagids																								X
Sand fish																								X
Euphausiids	1				X						X					X	X							X
Pholids and Stichaeids	2-4				X									X		X	X					X	X	
Gonostomatids																								X

D.1 Walleye pollock

Pollock occur throughout the BSAI and GOA FMP management areas, and straddle into the Canadian and Russian exclusive economic zones (EEZs), the international waters of the central Bering Sea, and into the Chukchi Sea. Stocks occurring in the management area are the eastern Bering Sea, Aleutian Basin, and Aleutian Islands stocks.

D.1.1 Life History and General Distribution

Pollock is the most abundant species within the eastern Bering Sea comprising 75-80% of the catch and 60% of the biomass.

Four stocks of pollock are recognized for management purposes: Gulf of Alaska, eastern Bering Sea, Aleutian Islands, and Aleutian Basin. There appears to be a high degree of interrelationship among the eastern Bering Sea, Aleutian Islands, and Aleutian Basin stocks with suggestions of movement from one area to the others. There appears to be stock separation between the Gulf of Alaska stocks and stocks to the north.

The most abundant stock of pollock is the eastern Bering Sea stock which is primarily distributed over the eastern Bering Sea outer continental shelf between approximately 70-200 m. Information on pollock distribution in the eastern Bering Sea comes from commercial fishing locations, annual bottom trawl surveys and triennial acoustic surveys.

The Aleutian Islands stock extends through the Aleutian Islands from 170° W. to the end of the Aleutian Islands (Attu Island), with the greatest abundance in the eastern Aleutians (170° W. to Seguam Pass). Most of the information on pollock distribution in the Aleutian Islands comes from triennial bottom trawl surveys. These surveys indicate that pollock are primarily located on the Bering Sea side of the Aleutian Islands, and have a spotty distribution throughout the Aleutian Islands chain. The bottom trawl data may not provide an accurate view of pollock distribution because a significant portion of the pollock biomass may be pelagic and not available to bottom trawls, and secondly many areas of the Aleutian Islands shelf are untrawlable due to rough bottom.

The third stock, Aleutian Basin, appears to be distributed throughout the Aleutian Basin which encompasses the U.S. EEZ, Russian EEZ, and international waters in the central Bering Sea. This stock appears to move throughout the Basin for feeding, but concentrate in deepwater near the continental shelf for spawning. The principal spawning location is near Bogoslof Island in the eastern Aleutian Islands, but data from pollock fisheries in the first quarter of the year indicate that there are other concentrations of deepwater spawning in the western Aleutian Islands. The Aleutian Basin spawning stock appears to be derived from migrants from the eastern Bering Sea shelf stock, and possibly some western Bering Sea pollock. Recruitment to the stock occurs generally around age 5, very few pollock younger than age 5 have been found in the Aleutian Basin. Most of the pollock in the Aleutian Basin appear to originate from strong year classes.

Peak pollock spawning occurs on the southeastern Bering Sea and eastern Aleutian Islands along the outer continental shelf around mid-March. North of the Pribilof Islands spawning occurs later (April-May) in smaller spawning aggregations. The deep spawning pollock of the Aleutian Basin appear to spawn slightly earlier, late February-early March.

Spawning occurs pelagically and eggs develop throughout the water column (70-80 m in the Bering Sea shelf). Development is dependent on water temperature. Eggs take about 17-20 days to develop at 4° C in the Bogoslof area and 25.5 days at 2° C on the shelf. Larvae are also distributed in the upper water column, with the larval period lasting approximately 60 days. The larvae eat progressively larger naupliar stages of copepods as they grow and then small euphausiids as they approach transformation to juveniles (~25 mm standard length). Fisheries-Oceanography Coordinated Investigations survey data indicate larval pollock may utilize the stratified warmer upper waters of the mid-shelf to avoid predation by adult pollock which reside in the colder bottom water.

At age 1 pollock are found throughout the eastern Bering Sea both pelagically and on bottom. Age 1 pollock from strong year-classes appear to be found in great numbers on the inner shelf, and further north on the shelf than weak year classes which appear to be more concentrated on the outer continental shelf. From age 2-3 pollock are primarily pelagic and then to be most abundant on the outer and mid-shelf northwest of the Pribilof Islands. As pollock reach maturity (age 4), they appear to move from the northwest to the southeast shelf to recruit to the adult spawning population. Strong year-classes of pollock persist in the population in significant numbers until about age 12, and very few pollock survive beyond age 16. The oldest recorded pollock was age 31.

Growth varies by area with the largest pollock occurring on the southeastern shelf. On the northwest shelf the growth rate is slower. A newly maturing pollock is around 40 cm. The upper size limit for juvenile pollock in the eastern Bering Sea is about 38-42 cm. This is the size of 50% maturity.

BSAI Pollock

Age	Mean length (cm)			Mean weight (kg)	Maturity
	Southeast Shelf	Northwest Shelf	eastern Bering Sea	eastern Bering Sea	
2	29.8	25.9	28.2	0.170	1%
3	36.1	31.9	34.5	0.303	29%
4	41.1	36.7	39.5	0.447	64%
5	45.1	40.6	43.4	0.589	84%
6	48.2	43.7	46.6	0.722	90%
7	50.7	46.2	49.1	0.840	95%
8	52.6	48.3	51.1	0.942	96%
9	54.2	49.9	52.7	1.029	97%
10	55.4	51.2	54.0	1.102	97%
11	56.4	52.3	55.0	1.163	100%
12	57.1	53.1	55.8	1.212	100%
13	57.7	53.8	56.5	1.253	100%
14	58.2	54.4	57.0	1.286	100%
15	58.6	54.8	57.4	1.312	100%

Sources for additional distribution data

Eggs and Larvae:

Art Kendall, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA, 206-526-4108.

Richard Brodeur, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA, 206-526-4318.

Shallow water concentrations:

Bill Bechtol, Alaska Department of Fish and Game, 3298 Douglas Place, Homer, Alaska 99603-8027.

D.1.2 Fishery

Since the implementation of Amendment 14 in 1991, the eastern Bering Sea pollock fishery has been divided into two fishing periods: a roe-bearing "A" season fishery generally occurring in January-March, and a nonroe-bearing "B" season fishery generally occurring in August-October. The "A" season concentrates

fishing effort on prespawning pollock in the southeastern Bering Sea. During the "B" season, fishing is still primarily in the southeastern Bering Sea, but some fishing also occurs on the northwestern shelf. Also during the "B" season, catcher processor vessels are required to fish north of 56° N. latitude because the area to the south is reserved for catcher vessels delivering to shoreside processing plants on Unalaska and Akutan.

Nearly the entire harvest of pollock is taken with pelagic trawl gear. In 1996 pelagic trawls took 91% of the pollock harvest. The pollock fishery has a very low bycatch rate with discards 10% or less since 1992. Most of the discards in the pollock fishery are juvenile pollock, or pollock too large to fit filleting machines. In the pelagic trawl fishery the catch is almost exclusively pollock, but in the bottom trawl pollock fishery the bycatch of other species is higher. Between 1991 and 1994 the bycatch of other species was 18% in the bottom trawl pollock fishery, and 3% in the pelagic trawl pollock fishery. Most of the bycatch was Pacific cod and flatfish species.

The eastern Bering Sea pollock fishery primarily harvests mature pollock. The 50% selectivity corresponds to the age of 50% maturity, age 4. Fishery selectivity increases to a maximum around age 7-8 and then declines. The reduced selectivity for older ages is due to pollock becoming increasingly demersal with age. Younger pollock form large schools and are semi-demersal, thereby being easier to locate by fishing vessels. Immature fish (ages 2 and 3) are usually caught in low numbers. Generally the catch of immature pollock increases when strong year-classes occur and the abundance of juveniles increase sharply. This occurred with the 1989 year-class, the second largest year-class on record. Juvenile bycatch increased sharply in 1991 and 1992 when this year-class was age 2 and 3. A secondary problem is that strong to moderate year-classes may reside in the Russian EEZ adjacent to the U. S. EEZ as juveniles. Russian catch-age data and anecdotal information suggest that juveniles may comprise a major portion of the catch. There is a potential for the Russian fishery to reduce subsequent abundance in the U. S. fishery.

Eastern Bering Sea

Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Selectivity	5%	27%	50%	70%	90%	100%	88%	89%	77%	79%	79%	77%	87%	87%

D.1.3 Relevant Trophic Information

Juvenile pollock through newly maturing pollock primarily utilize copepods and euphausiids for food. At maturation and older ages pollock become increasingly piscivorous, with pollock (cannibalism) a major food item in the Bering Sea. Most of the pollock consumed by pollock are age 0 and 1 pollock, and recent research suggests that cannibalism can regulate year-class size. Weak year-classes appear to be those located within the range of adults, while strong year-classes are those that are transported to areas outside the range of adult abundance.

Being the dominant species in the eastern Bering Sea, pollock is an important food source for other fish, marine mammals, and birds. On the Pribilof Islands hatching success and fledgling survival of marine birds has been tied to the availability of age 0 pollock to nesting birds.

D.1.4 Habitat and Biological Associations

Egg-Spawning: Pelagic on outer continental shelf generally over 100-200 m depth in Bering Sea.

Larvae: Pelagic outer to mid-shelf region in Bering Sea.

Juveniles: Age 0 appears to be pelagic, as is age 2 and 3. Age 1 pelagic and demersal with a widespread distribution and no known benthic habitat preference.

Adults: Adults occur both pelagically and demersally on the outer and mid-continental shelf of the eastern Bering Sea and Aleutian Islands. In the eastern Bering Sea few adult pollock occur in waters shallower than 70 m. Adult pollock also occur pelagically in the Aleutian Basin. Adult pollock range throughout the Bering Sea in both the U.S. and Russian waters, however, the maps provided for this document detail distributions for pollock in the U.S. EEZ and the basin.

Habitat and Biological Associations: Walleye Pollock

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	17-20 days at 4°C	None	Feb-Apr	OCS, MCS	P	NA	G?	
Larvae	60 days	copepod naupli and small euphausiids	Mar-Jul	OCS	P	NA	G? F	pollock larvae with jellyfish
Juveniles	Age 0.4 to Age 4	Pelagic crustaceans, copepods and euphausiids	Aug+	OCS, MCS, ICS	P, SD	NA	CL, F	
Adults	Age 4 - 16	Pelagic crustaceans and fish, primarily juvenile pollock	spawning Feb-Apr	OCS, BSN	P, SD	U	F, UP	Increasingly demersal with age. Appears to prefer 2-3°C water for spawning.

D.1.5 Literature

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D.2 Pacific cod

D.2.1 Life History and General Distribution

Pacific cod is a transoceanic species, occurring at depths from shoreline to 500 m. The southern limit of the species' distribution is about 34° N. latitude, with a northern limit of about 63° N. latitude. Adults are demersal and form aggregations during the peak spawning season, which extends approximately from January through May. Pacific cod eggs are demersal and adhesive. Eggs hatch in about 15-20 days. Little is known about the distribution of Pacific cod larvae, which undergo metaphorphosis at about 25-35 mm. Juvenile Pacific cod start appearing in trawl surveys at a fairly small size, as small as 10 cm in the eastern Bering Sea. Pacific cod can grow to be more than a meter in length, with weights in excess of 10 kg. Natural mortality is believed to be somewhere between 0.3 and 0.4. Approximately 50% of Pacific cod are mature by ages 5-6. The estimated size at 50% maturity is 67 cm. The maximum recorded age of a Pacific cod from the BSAI or Gulf of Alaska is 19 years.

Sources for additional distribution data

Larvae/juveniles:
NMFS, Alaska Fisheries Science Center, FOCI Program, Ann Matarese 206-526-4111

D.2.2 Fishery

The fishery is conducted with bottom trawl, longline, pot, and jig gear. The age at 50% recruitment varies between gear types and regions. In the BSAI, the age at 50% recruitment is 3 years for trawl gear and 4 years for other longline and pot gear. More than 100 vessels participated in each of the three largest fisheries (trawl, longline, pot). The trawl fishery is typically concentrated during the first few months of the year, whereas fixed-gear fisheries may sometimes run essentially year-round. Bycatch of crab and halibut often causes the Pacific cod fisheries to close prior to reaching the total allowable catch. In the BSAI, trawl fishing is concentrated immediately north of Unimak Island, whereas the longline fishery is distributed along the shelf edge to the north and west of the Pribilof Islands.

D.2.3 Relevant Trophic Information

Pacific cod are omnivorous. In terms of percent occurrence, the most important items in the diet of Pacific cod are polychaetes, amphipods, and crangonid shrimp. In terms of numbers of individual organisms consumed, the most important dietary items are euphausiids, miscellaneous fishes, and amphipods. In terms of weight of organisms consumed, the most important dietary items are walleye pollock, fishery discards, and yellowfin sole. Small Pacific cod feed mostly on invertebrates, while large Pacific cod are mainly piscivorous. Predators of Pacific cod include halibut, salmon shark, northern fur seals, sea lions, harbor porpoises, various whale species, and tufted puffin.

D.2.4 Habitat and Biological Associations

Egg/Spawning: Spawning takes place in the sublittoral-bathyal zone (40-290 m) near bottom. Eggs sink to the bottom after fertilization, and are somewhat adhesive. Optimal temperature for incubation is 3-6° C, optimal salinity is 13-23 ppt, and optimal oxygen concentration is from 2-3 ppm to saturation. Little is known about the optimal substrate type for egg incubation.

Larvae: Larvae are epipelagic, occurring primarily in the upper 45 m of the water column shortly after hatching, moving downward in the water column as they grow.

Juveniles: Juveniles occur mostly over the inner continental shelf at depths of 60-150 m.

Adults: Adults occur in depths from the shoreline to 500 m. Average depth of occurrence tends to vary directly with age for at least the first few years of life, with mature fish concentrated on the outer continental shelf. Preferred substrate is soft sediment, from mud and clay to sand.

Habitat and Biological Associations: Pacific cod

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	15-20 days	NA	winter-spring	ICS, MCS, OCS	D	M, SM, MS, S	U	optimum 3-6°C optimum 13-23 ppt
Larvae	U	copepods (?)	winter-spring	U	P (?)	U	U	
Early Juveniles	to 2 years	small invertebrates (mysids, euphausiids, shrimp)	all year	ICS, MCS	D	M, SM, MS, S	U	
Late Juveniles	to 5 years	pollock, flatfish, crab, fishery discards	all year	ICS, MCS, OCS	D	M, SM, MS, S	U	
Adults	5+ years	pollock, flatfish, fishery discards, crab	spawning (Jan-May) non-spawning (Jun-Dec)	ICS, MCS, OCS ICS, MCS, OCS	D	M, SM, MS, S	U	

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D.3 Yellowfin sole

D.3.1 Life History and General Distribution

Yellowfin sole are distributed in North American waters from off British Columbia, Canada, (approximately 49° N. latitude) to the Chukchi Sea (about 70° N. latitude) and south along the Asian coast to about 35° N. latitude off the South Korean coast in the Sea of Japan. Adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions on the eastern Bering Sea shelf. From over-winter grounds near the shelf margins, adults begin a migration onto the inner shelf in April or early May each year for spawning and feeding. A protracted and variable spawning period may range from as early as late May through August occurring primarily in shallow water. Fecundity varies with size and was reported to range from 1.3 to 3.3 million eggs for fish 25-45 cm long. Eggs have been found to the limits of inshore ichthyoplankton sampling over a widespread area to at least as far north as Nunivak Island. Larvae have been measured at 2.2-5.5 mm in July and 2.5-12.3 mm in late August - early September. The age or size at metamorphosis is unknown. Juveniles are separate from the adult population, remaining in shallow areas until they reach approximately 15 cm. The estimated age of 50% maturity is 10.5 yrs (approximately 29 cm) for females based on samples collected in 1992 and 1993. The upper size limit of juvenile yellowfin sole is approximately 27 cm. Natural mortality rate is believed to range from 0.12-0.16.

D.3.2 Fishery

Yellowfin sole are caught in bottom trawls both as a directed fishery and in the pursuit of other bottom-dwelling species. Recruitment begins at about age 6, and they are fully selected at age 13. Historically, the fishery has occurred throughout the mid and inner Bering Sea shelf during ice-free conditions although much effort has been directed at the spawning concentrations in nearshore northern Bristol Bay. They are caught as bycatch in Pacific cod, bottom pollock and other flatfish fisheries and are caught with these species and Pacific halibut in yellowfin sole directed fisheries.

D.3.3 Relevant Trophic Information

Groundfish predators include Pacific cod, skates and Pacific halibut, mostly on fish ranging from 7 to 25 cm standard length. Adults eat polychaetes, bivalves, amphipods, and echiurids.

D.3.4 Habitat and Biological Associations

Larvae/Juveniles: Planktonic larvae for at least 2-3 months until metamorphosis occurs, usually inhabiting shallow areas.

Adults: Summertime spawning and feeding on sandy substrates of the eastern Bering Sea shelf. Widespread distribution mainly on the middle and inner portion of the shelf, feeding mainly on bivalves, polychaetes, amphipods and echiurids.. Wintertime migration to deeper waters of the shelf margin to avoid extreme cold water temperatures, feeding diminishes.

Habitat and Biological Associations: Yellowfin sole

Stage - EFH Level	Duration or Age	Diet/Prey	Season/Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs		NA	summer	BAY, BCH	P			
Larvae	2-3 months?	U phyto/zooplankton?	summer autumn?	BAY, BCH, ICS	P			
Early Juveniles	to 5.5 years	polychaetes, bivalves, amphipods, echiurids	all year	BAY, ICS, OCS	D	S[1]		
Late Juveniles	5.5 to 10 years	polychaetes, bivalves, amphipods, echiurids	all year	BAY, ICS, OCS	D	S[1]		
Adults	10+ years	polychaetes, bivalves, amphipods, echiurids	spawning/feeding May-August non-spawning Nov.-April	BAY, BCH, ICS ICS, MCS, OCS	D	S[1]	ice edge	

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D.3.5 Literature

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D.4 Greenland turbot

D.4.1 Life History and General Distribution

Greenland turbot has an amphiboreal distribution, occurring in the North Atlantic and North Pacific, but not in the intervening Arctic Ocean. In the North Pacific, species abundance is centered in the eastern Bering Sea and, secondly, in the Aleutians. On the Asian side, they occur in the Gulf of Anadyr along the Bering Sea coast of Russia, in the Okhotsk Sea, around the Kurile Islands, and south to the east coast of Japan to northern Honshu Island (Hubbs and Wilimovsky 1964, Mikawa 1963, Shuntov 1965). Adults exhibit a benthic lifestyle, living in deep waters of the continental slope but are known to have a tendency to feed off the sea bottom. During their first few years as immature fish, they inhabit relatively shallow continental shelf waters (<200 m) until about age 4 or 5 before joining the adult population (200 - 1,000 m or more, Templeman 1973). Adults appear to undergo seasonal shifts in depth distribution moving deeper in winter and shallower in summer (Chumakov 1970, Shuntov 1965). Spawning is reported to occur in winter in the eastern Bering Sea and may be protracted starting in September or October and continuing until March with an apparent peak period in November to February (Shuntov 1970, Bulatov 1983). Females spawn relatively small numbers of eggs with fecundity ranging from 23,900 to 149,300 for fish 83 cm and smaller in the Bering Sea (D'yakov 1982).

Eggs and early larval stages are benthypelagic (Musienko 1970). In the Atlantic Ocean, larvae (10-18 cm) have been found in benthypelagic waters which gradually rise to the pelagic zone in correspondence to absorption of the yolk sac which is reported to occur at 15-18 mm with the onset of feeding (Pertseva-Ostroumova 1961 and Smidt 1969). The period of larval development extends from April to as late as August or September (Jensen 1935) which results in an extensive larval drift and broad dispersal from the spawning waters of the continental slope. Metamorphosis occurs in August or September at about 7-8 cm in length at which time the demersal life begins. Juveniles are reported to be quite tolerant of cold temperatures to less than zero degrees Celsius (Hognestad 1969) and have been found on the northern part of the Bering Sea shelf in summer trawl surveys (Alton et al. 1988).

The age of 50% maturity is estimated to range from 5-10 years (D'yakov 1982, 60 cm used in stock assessment) and a natural mortality rate of 0.18 has been used in the most recent stock assessments (Ianelli et al. 1996). The upper size limit of juvenile greenland turbot is approximately 59 cm.

D.4.2 Fishery

Caught in bottom trawls and on longlines both as a directed fishery and in the pursuit of other bottom-dwelling species (primarily sablefish). Recruitment begins at about 50 and 60 cm in the trawl and longline fisheries, respectively. The fishery operates on the continental slope throughout the eastern Bering Sea and on both sides of the Aleutian Islands. Bycatch primarily occurs in the sablefish directed fisheries and also to a smaller extent in the Pacific cod fishery.

D.4.3 Relevant Trophic Information

Groundfish predators include Pacific cod, pollock and yellowfin sole, mostly on fish ranging from 2 to 5 cm standard length (probably age 0). Juveniles feed primarily on euphausiids, polychaetes, and small walleye pollock. Adults feed on walleye pollock and other miscellaneous fish species.

D.4.4 Habitat and Biological Associations

Larvae/Juveniles: Planktonic larvae for up to 9 months until metamorphosis occurs, usually with a widespread distribution inhabiting shallow waters. Juveniles live on continental shelf until about age 4 or 5 feeding primarily on euphausiids, polychaetes and small walleye pollock..

Adults: Inhabit continental slope waters with annual spring/fall migrations from deeper to shallower waters. Diet consists of walleye pollock and other miscellaneous fish species.

Habitat and Biological Associations: Greenland turbot

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs		NA	winter	OCS, MCS	SD, SP			
Larvae	8-9 months	U phyto/zooplankton?	Spring summer	OCS, ICS, MCS	P			
Juveniles	1-5 years	euphausiids polychaets small pollock	all year	ICS, MCS, OCS, USP	D, SD	MS, M[1]		
Adults	5+ years	pollock small fish	spawning Nov-Feb non-spawning Mar-Oct	OCS, USP, LSP OCS, USP, LSP	D, SD	MS, M[1]		

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D.5 Arrowtooth flounder

D.5.1 Life History and General Distribution

Arrowtooth flounder are distributed in North American waters from central California to the eastern Bering Sea on the continental shelf and upper slope.

Adults exhibit a benthic lifestyle and occupy separate winter and summer distributions on the eastern Bering Sea shelf. From over-winter grounds near the shelf margins and upper slope areas, adults begin a migration onto the middle and inner shelf in April or early May each year with the onset of warmer water temperatures. A protracted and variable spawning period may range from as early as September through March (Rickey 1994, Hosie 1976). Little is known of the fecundity of arrowtooth flounder. Larvae have been found from ichthyoplankton sampling over a widespread area of the eastern Bering Sea shelf in April and May (Waldron and Vinter 1978). The age or size at metamorphosis is unknown. Juveniles are separate from the adult population, remaining in shallow areas until they reach the 10-15 cm range. The estimated length at 50% maturity is 28 cm for males (4 years) and 37 cm for females (5 years) from samples collected off the Washington coast (Rickey 1994). The natural mortality rate used in stock assessments is 0.2 (Wilderbuer and Sample 1996). The upper size limit of juvenile fish is 27 cm for males and 37 cm for females.

D.5.2 Fishery

Caught in bottom trawls usually in pursuit of other higher value bottom-dwelling species. Historically have been undesirable to harvest due to a flesh softening condition caused by protease enzyme activity. Recruitment begins at about age 3 and females are fully selected at age 10. They are caught as bycatch in Pacific cod, bottom pollock, sablefish and other flatfish fisheries.

D.5.3 Relevant Trophic Information

Very important as a large, aggressive and abundant predator of other groundfish species. Groundfish predators include Pacific cod and pollock, mostly on small fish.

D.5.4 Habitat and Biological Associations

Larvae/Juveniles: Planktonic larvae for at least 2-3 months until metamorphosis occurs, juveniles usually inhabit shallow areas until about 10 cm in length.

Adults: Widespread distribution mainly on the middle and outer portions of the continental shelf, feeding mainly on walleye pollock and other miscellaneous fish species when arrowtooth flounder attain lengths greater than 30 cm. Wintertime migration to deeper waters of the shelf margin and upper continental slope to avoid extreme cold water temperatures and for spawning.

Habitat and Biological Associations: Arrowtooth flounder

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs		NA	winter, spring?	ICS, OCS	P			
Larvae	2-3 months?	U phyto/zooplankton?	Spring summer?	BAY, ICS, OCS	P			
Early Juveniles	to 2 years	euphausiids, crustaceans, amphipods, pollock	all year	ICS, OCS, USP	D	G, MS[1]		
Late Juveniles	males: 2-4 years females: 2-5 years	euphausiids, crustaceans, amphipods, pollock	all year	ICS, OCS, USP	D	G, MS[1]		
Adults	males: 4+ years females: 5+ years	pollock, misc. fish, Gadidae sp., euphausiids	spawning Nov-Mar non-spawning Apr-Oct	OCS, USP ICS, OCS, USP, BAY	D	G, MS[1]	ice edge	

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D.6 Rock sole

D.6.1 Life History and General Distribution

Rock sole are distributed from California waters north into the Gulf of Alaska and Bering Sea to as far north as the Gulf of Anadyr. The distribution continues along the Aleutian Islands westward to the Kamchatka Peninsula and then southward through the Okhotsk Sea to the Kuril Islands, Sea of Japan, and off Korea. Centers of abundance occur off the Kamchatka Peninsula (Shubnikov and Lisovenko 1964), British Columbia (Forrester and Thompson 1969), the central Gulf of Alaska, and in the southeastern Bering Sea (Alton and Sample 1975). Adults exhibit a benthic lifestyle and, in the eastern Bering Sea, occupy separate winter (spawning) and summertime feeding distributions on the continental shelf. Rock sole spawn during the winter-early spring period of December-March. Soviet investigations in the early 1960s established two spawning concentrations: an eastern concentration north of Unimak Island at the mouth of Bristol Bay and a western concentration eastward of the Pribilof Islands between 55°30' and 55°0' N. latitude and approximately 165°2' W. longitude (Shubnikov and Lisovenko, 1964). Rock sole spawning in the eastern and western Bering Sea was found to occur at depths of 125-250 m, close to the shelf/slope break. Spawning females deposit a mass of eggs which are demersal and adhesive (Alton and Sample 1975). Fertilization is believed to be external. Incubation time is temperature dependent and may range from 6.4 days at 11° C to about 25 days at 2.9° C (Forrester 1964). Newly hatched larvae are pelagic and have occurred sporadically in eastern Bering Sea plankton surveys (Waldron and Vinter, 1978). Kamchatka larvae are reportedly 20 mm in length when they assume their side-swimming, bottom-dwelling form (Alton and Sample 1975). Forrester and Thompson (1969) report that by age 1 they are found with adults on the continental shelf during summer.

In the springtime, after spawning, rock sole begin actively feeding and commence a migration to the shallow waters of the continental shelf. This migration has been observed on both the eastern (Alton and Sample, 1975) and western (Shvetsov 1978) areas of the Bering Sea. During this time they spread out and form much less dense concentrations than during the spawning period. Summertime trawl surveys indicate most of the population can be found at depths from 50-100 m (Armistead and Nichol 1993). The movement from winter/spring to summer grounds is in response to warmer temperatures in the shallow waters and the distribution of prey on the shelf seafloor (Shvetsov 1978). In September, with the onset of cooling in the northern latitudes, rock sole begin the return migration to the deeper wintering grounds. Fecundity varies with size and was reported to be 450,00 eggs for fish 42 cm long. Larvae are pelagic but their occurrence in plankton surveys in the eastern Bering Sea are rare (Musienko 1963). The age or size at metamorphosis is unknown. Juveniles are separate from the adult population, remaining in shallow areas until they reach age 1 (Forrester 1969). The estimated age of 50% maturity is 9 years (approximately 35 cm) for females and natural mortality rate is believed to range from 0.18 - 0.20. The upper size limit of juvenile rock sole is approximately 34 cm.

D.6.2 Fishery

Caught in bottom trawls both as a directed fishery and in the pursuit of other bottom-dwelling species. Recruitment begins at about age 4 and they are fully selected at age 11. Historically, the fishery has occurred throughout the mid and inner Bering Sea shelf during ice-free conditions and on spawning concentrations north of the Alaska Peninsula during winter for their high-value roe. They are caught as bycatch in Pacific

cod, bottom pollock and other flatfish fisheries and are caught with these species and Pacific halibut in rock sole directed fisheries.

D.6.3 Relevant Trophic Information

Groundfish predators include Pacific cod, walleye pollock, skates, Pacific halibut and yellowfin sole, mostly on fish ranging from 5 to 15 cm standard length. Adults feed on bivalves, polychaetes, amphipods and miscellaneous crustaceans.

D.6.4 Habitat and Biological Associations

Larvae/Juveniles: Planktonic larvae for at least 2-3 months until metamorphosis occurs, juveniles inhabit shallow areas at least until age 1.

Adults: Summertime feeding on primarily sandy substrates of the eastern Bering Sea shelf. Widespread distribution mainly on the middle and inner portion of the shelf. Wintertime migration to deeper waters of the shelf margin for spawning and to avoid extreme cold water temperatures, feeding diminishes.

Habitat and Biological Associations: Rock sole

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs		NA	winter	OCS	D			
Larvae	2-3 months?	U phyto/zooplankton?	winter/ spring	OCS, MCS, ICS	P			
Early Juveniles	to 3.5 years	polychaetes, bivalves, amphipods, misc. crust.	all year	BAY, ICS, OCS	D	S[1]		
Late Juveniles	to 9 years	polychaetes, bivalves, amphipods, misc. crust.	all year	BAY, ICS, OCS	D	S[1]		
Adults	9+ years	polychaetes, bivalves, amphipods, misc. crust.	feeding May-Sep spawning Dec-Apr	MCS, ICS MCS, OCS	D	S[1]	ice edge	

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D.7 Other flatfish

D.7.1 Life History and General Distribution

The “other flatfish” species complex is made up of the following flatfishes:

Alaska plaice (*Pleuronectes quadrituberculatus*)
rex sole (*Errex zachirus*)
Dover sole (*Microstomus pacificus*)
starry flounder (*Platichthys stellatus*)
longhead dab (*Pleuronectes proboscidea*)
butter sole (*Pleuronectes isolepis*)

Alaska plaice is the most abundant and commercially important species of the complex and the description of its habitat and life history are given.

Alaska plaice inhabit continental shelf waters of the North Pacific ranging from the Gulf of Alaska to the Bering and Chukchi Seas and in Asian waters as far south as Peter the Greate Bay (Pertseva-Ostroumova 1961; Quast and Hall 1972). Adults exhibit a benthic lifestyle and live year round on the shelf and move seasonally within its limits (Fadeev 1965). From over-winter grounds near the shelf margins, adults begin a migration onto the central and northern shelf of the eastern Bering Sea, primarily at depths of less than 100 m. Spawning usually occurs in March and April on hard sandy ground (Zhang 1987). The eggs and larvae are pelagic and transparent and have been found in ichthyoplankton sampling in late spring and early summer over a widespread area of the continental shelf (Waldron and Favorite 1977).

Fecundity estimates (Fadeev 1965) indicate female fish produce an average of 56,000 eggs at lengths of 28 to 30 cm and 313,000 eggs at lengths of 48 to 50 cm. The age or size at metamorphosis is unknown. The estimated length of 50% maturity is 32 cm from collections made in March and 28 cm from April, which corresponds to an age of 6 to 7 years. Natural mortality rate estimates range from 0.19 to 0.22 (Wilderbuer and Zhang, in press). The approximate upper size limit of juvenile other flatfish is 27 cm.

D.7.2 Fishery

Caught in bottom trawls both as a directed fishery and in the pursuit of other bottom-dwelling species. Recruitment begins at about age 6, and they are fully selected at age 12. The fishery occurs throughout the mid and inner Bering Sea shelf during ice-free conditions. They are caught as bycatch in Pacific cod, bottom pollock and other flatfish fisheries and are caught with these species and Pacific halibut the directed fishery.

D.7.3 Relevant Trophic Information

Groundfish predators include Pacific halibut (Novikov, 1964) yellowfin sole, beluga whales and fur seals Salveson 1976). Adults feed on polychaetes, amphipods and echiurids.

D.7.4 Habitat and Biological Associations

Larvae/Juveniles: Planktonic larvae for at least 2-3 months until metamorphosis occurs, usually inhabiting shallow areas.

Adults: Summertime feeding on sandy substrates of the eastern Bering Sea shelf. Wide-spread distribution mainly on the middle, northern portion of the shelf. Wintertime migration to deeper waters of the shelf margin to avoid extreme cold water temperatures. Feeding diminishes until spring after spawning.

Habitat and Biological Associations: Alaska plaice

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs		NA	spring and summer	ICS, OCS	P			
Larvae	2-4 months?	U phyto/zooplankton?	spring and summer	ICS, MCS	P			
Juveniles	up to 7 years	polychaetes, amphipods, echiurids	all year	ICS, MCS	D	MS[1]		
Adults	7+ years	polychaetes, amphipods, echiurids	spawning Mar-May non-spawning and feeding Jun-Feb	ICS, MCS ICS, MCS	D	MS[1]	 ice edge	

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D.8 Flathead sole

D.8.1 Life History and General Distribution

Flathead sole are distributed from northern California, off Point Reyes, northward along the west coast of North America and throughout the Gulf of Alaska and the Bering Sea, the Kuril Islands and possibly the Okhotsk Sea (Hart 1973).

Adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions on the eastern Bering Sea shelf. From over-winter grounds near the shelf margins, adults begin a migration onto the mid and outer continental shelf in April or May each year for feeding. The spawning period may range from as early as January but is known to occur in March and April, primarily in deeper waters near the margins of the continental shelf. Eggs are large (2.75-3.75 mm) and females have egg counts ranging from about 72,000 (20 cm fish) to almost 600,000 (38 cm fish). Eggs hatch in 9 to 20 days depending on incubation temperatures within the range of 2.4 to 9.8°C and have been found in ichthyoplankton sampling on the southern portion of the Bering Sea shelf in April and May (Waldron 1981). Larvae absorb the yolk sac in 6 to 17 days, but the extent of their distribution is unknown. The age or size at metamorphosis is unknown, as well as the age at 50% maturity. Juveniles less than age 2 have not been found with the adult population, remaining in shallow areas. The natural mortality rate used in recent stock assessments is 0.2.

D.8.2 Fishery

Caught in bottom trawls both as a directed fishery and in the pursuit of other bottom-dwelling species. Recruitment begins at about age 3. Historically, the fishery has occurred throughout the mid and outer Bering Sea shelf during ice-free conditions (mostly summer and fall). They are caught as bycatch in Pacific cod, bottom pollock and other flatfish fisheries and are caught with these species and Pacific halibut in flathead sole directed fisheries.

D.8.3 Relevant Trophic Information

Groundfish predators include Pacific cod, Pacific halibut, arrowtooth flounder and also cannibalism by large flathead sole, mostly on fish less than 20 cm standard length. Adults feed mainly on ophiuroids, tanner crab, osmerids, bivalves and polychaetes.

D.8.4 Habitat and Biological Associations

Larvae/Juveniles: Planktonic larvae for an unknown time period until metamorphosis occurs, usually inhabiting shallow areas.

Adults: Winter spawning and summer feeding on sand and mud substrates of the continental shelf. Widespread distribution mainly on the middle and outer portion of the shelf.

Habitat and Biological Associations: Flathead sole

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs		NA	winter	ICS, MCS, OCS	P			
Larvae	U	U phyto/zooplankton?	spring summer	ICS, MCS, OCS	P			
Early Juveniles	to 2 years	polychaetes, bivalves, ophiuroids, pollock, Tanner crab	all year	MCS, ICS, OCS	D	MS[1]		
Late Juveniles	3 years	polychaetes, bivalves, ophiuroids, pollock, Tanner crab	all year	MCS, ICS, OCS	D	MS[1]		
Adults	U	polychaetes, bivalves, ophiuroids, pollock, Tanner crab	spawning Jan-Apr non-spawning May-Dec	MCS, OCS, ICS ICS, MCS, OCS	D	MS[1]	ice edge	

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D.9 Sablefish

D.9.1 Life History and General Distribution

Sablefish are distributed from Mexico through the Gulf of Alaska to the Aleutian Chain, Bering Sea; along the Asian coast from Sagami Bay, and along the Pacific sides of Honshu and Hokkaido Islands and the Kamchatkan Peninsula. Adult sablefish occur along the continental slope, shelf gulleys, and in deep fjords such as Prince William Sound and Southeastern Alaska, at depths generally greater than 200 m. Adults are assumed to be demersal. Spawning or very ripe sablefish are observed in late winter or early spring along the continental slope. Eggs are apparently released near the bottom where they incubate. After hatching and yolk adsorption the larvae rise to the surface where they have been collected with neuston nets. Larvae are oceanic through the spring and by late summer, small pelagic juveniles (10-15 cm) have been observed along the outer coasts of Southeast Alaska, where they apparently move into shallow waters to spend their first winter. During most years, there are only a few places where juveniles have been found during their first winter and second summer. It is not clear if the juvenile distribution is highly specific or appears so because sampling is highly inefficient and sparse. During the occasional times of large year-classes the juveniles are easily found in many inshore areas during their second summer. They are typically 20-30 cm in length during their second summer, after which they apparently leave the nearshore bays. One or two years later they begin appearing on the continental shelf and move to their adult distribution as they mature. Size at 50% maturity in the Bering Sea is 65 cm for males and 67 cm for females; in the Aleutian Islands, it is 61 cm for males and 65 cm for females. At the end of the second summer (~1.5 years old) they are 35-40 cm in length.

<u>Sources of additional distribution data</u>

Eggs and Larvae:

NMFS, Alaska Fisheries Science Center, FOCI Program, Art Kendall 206-526-4108, NMFS Auke Bay Lab, Bruce Wing 907-789-????

Juveniles:

ADFG groundfish surveys: Jim Blackburn, ADFG, Kodiak AK 907-486-186, Paul Anderson, NMFS/RACE, Kodiak AK 907-487-4961

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D.9.2 Fishery

The major fishery for sablefish in Alaska uses fixed gear (hook and line or pot gear), however sablefish are valuable in the trawl fishery as well. Sablefish enter the fixed gear fishery at 4-5 years of age, perhaps slightly younger in the trawl fishery. The fixed gear fishery takes place primarily in the spring and summer (the regulatory season is between March 15 and November 15). The take of the trawl share of sablefish occurs primarily in association with openings for other species, such as the July rockfish openings, where

they are taken as allowed bycatch. Deeper dwelling rockfish, such as shortraker, rougheye, and thornyhead rockfish are the primary bycatch in the fixed gear sablefish fishery. Halibut and rattails (*Albatrossia pectoralis* and *Corphaenoides acrolepis*) also are taken. By regulation, there is no directed trawl fishery for sablefish, however, directed fishing standards have allowed some trawl hauls to target sablefish, where the bycatch is similar to the fixed gear fishery, in addition perhaps to some deep dwelling flatfish.

D.9.3 Relevant Trophic Information

Larval sablefish feed on a variety of small zooplankton ranging from copepod naupli to small amphipods. The epipelagic juveniles feed primarily on macrozooplankton and micronekton (i.e., euphausiids).

The older demersal juveniles and adults appear to be opportunistic feeders, with food ranging from variety of benthic invertebrates, benthic fishes, as well as squid, mesopelagic fishes, jellyfish and fishery discards. Gadid fish (mainly pollock) comprise a large part of the sablefish diet. Nearshore residence during their second year provide the opportunity to feed on salmon fry and smolts during the summer months.

Young of the year sablefish are commonly found in the stomachs of salmon taken in the southeast troll fishery during the late summer.

Habitat and Biological Associations: Sablefish

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	14-20 days	NA	late winter-early spring: Dec-Apr	USP, LSP, BSN	P, 200-3000 m	NA	U	
Larvae	up to 3 months	copepod nauplii, small copepodites, etc	spring-summer: Apr-July	MCS, OCS, LSP, BSN	N, neustonic near surface	NA	U	
Early Juveniles	to 3 years	small prey fish, sandlance, salmon, herring, etc		OCS, MCS, ICS, during 1st summer, then obs'd in BAY, IP, until end of 2nd summer; not obs'd until found on shelf	P when offshore during 1st summer; D or SD/SP when inshore	NA when pelagic; bays where obs'd were soft bottomed, but not enough obs'd to assume typical	U ? or NA	
Late Juveniles	3-5 years	opportunistic: other fish, shellfish, worms, jellyfish, fishery discards	all year	continental slope, and deep shelf gulleys and fjords.	presumably D (caught with bottom tending gear)	varies, generally soft bottoms	U on slope, ? in fjords	
Adults	5 years to 35+	opportunistic: other fish, shellfish, worms, jellyfish, fishery discards	apparently year around, spawning movements (if any) are undescribed	continental slope, and deep shelf gulleys and fjords.	presumably D (caught with bottom tending gear)	varies, generally soft bottoms	U on slope, ? in fjords	

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D.10 Pacific ocean perch

D.10.1 Life History and General Distribution

Pacific ocean perch has a wide distribution in the North Pacific from southern California around the Pacific rim to northern Honshu Is., Japan, including the Bering Sea. The species appears to be most abundant in northern British Columbia, the Gulf of Alaska, and the Aleutian Islands. Adults are found primarily offshore along the continental slope in depths 180-420 m. Seasonal differences in depth distribution have been noted by many investigators. In the summer, adults inhabit shallower depths, especially those between 180 and 250 m. In the fall, the fish apparently migrate farther offshore to depths of ~300-420 m. They reside in these deeper depths until about May, when they return to their shallower summer distribution. This seasonal pattern is probably related to summer feeding and winter spawning. Although small numbers of Pacific ocean perch are dispersed throughout their preferred depth range on the continental slope, most of the population occurs in patchy, localized aggregations. At present, the best evidence indicates that Pacific ocean perch is mostly a demersal species. A number of investigators have speculated that there is also a pelagic component to their distribution, especially at night when they may move off-bottom to feed, but hard evidence for this is lacking.

There is much uncertainty about the life history of Pacific ocean perch, although generally more is known than for other rockfish species. The species appears to be viviparous, with internal fertilization and the release of live young. Insemination occurs in the fall, and sperm are retained within the female until fertilization takes place ~2 months later. The eggs develop and hatch internally, and parturition (release of larvae) occurs in April-May. Information on early life history is very sparse, especially for the first year of life. Positive identification of Pacific ocean perch larvae is not possible at present, but the larvae are thought to be pelagic and to drift with the current. Transformation to an adult form and the assumption of a demersal existence may take place within the first year. Small juveniles probably reside inshore in very rocky, high relief areas, and by age 3 begin to migrate to deeper offshore waters of the continental shelf. As they grow, they continue to migrate deeper, eventually reaching the continental slope, where they attain adulthood.

Pacific ocean perch is a very slow growing species, with a low rate of natural mortality (estimated at 0.05), a relatively old age at 50% maturity, and a very old maximum age of 98 years in Alaska. Despite their viviparous nature, the fish is relatively fecund with number of eggs/female in Alaska ranging from 10,000-300,000, depending upon size of the fish. The upper size limit of juvenile fish is unknown for both sexes.

Sources of additional distribution data

Eggs and Larvae:

NMFS, Alaska Fisheries Science Center, Auke Bay Laboratory, Bruce Wing, (907) 789-6043
NMFS, Alaska Fisheries Science Center, FOCI program, Art Kendall (206) 526-4108

Juveniles:

Carlson, H.R. and R.E. Haight. 1976 . Juvenile life of Pacific ocean perch, *Sebastes alutus*, in coastal fiords of southeastern Alaska: Their environment, growth, food habits, and schooling behavior. Trans. Am, Fish. Soc. 105:191-201.

D.10.2 Fishery

Pacific ocean perch are caught almost exclusively with bottom trawls. Age at 50% recruitment has been estimated to be 7.25 years in the BSAI. Most of the fish have been caught during the spring in March and April. The major fishing grounds are north of Unimak Pass, in Seguam and Amukta Pass, north of Atka Island, on Petrel Bank, south of Amchitka Island, and along the upper continental slope northwest of the Pribilof Islands. There is no bycatch information available for the Aleutian Islands and Bering Sea fisheries.

D.10.3 Relevant Trophic Information

All food studies of Pacific ocean perch have shown them to be overwhelmingly planktivorous. Small juveniles eat mostly calanoid copepods, whereas larger juveniles and adults consume euphausiids as their major prey items. Adults, to a much lesser extent, may also eat small shrimp and squids. It has been suggested that Pacific ocean perch and walleye pollock compete for the same euphausiid prey.

Documented predators of adult Pacific ocean perch include Pacific halibut and sablefish, and it is likely that Pacific cod and arrowtooth flounder also prey on Pacific ocean perch. Pelagic juveniles are consumed by salmon, and benthic juveniles are eaten by lingcod and other large demersal fish.

D.10.4 Habitat and Biological Associations

Egg/Spawning: Little information is known. Insemination is thought to occur after adults move to deeper offshore waters in the fall. Parturition is reported to occur from 20-30 m off bottom at depths of 360-400 m.

Larvae: Little information is known. Earlier information suggested that after parturition, larvae rise quickly to near surface, where they become part of the plankton. More recent data from British Columbia indicates that larvae may remain at depths >175 m for some period of time (perhaps two months), after which they slowly migrate upward in the water column.

Juveniles: Again, information is very sparse, especially for younger juveniles. After metamorphosis from the larval stage, juveniles may reside in a pelagic stage for an unknown length of time. They eventually become demersal, and at age 1-3 probably live in very rocky inshore areas. Afterward, they move to progressively deeper waters of the continental shelf. Older juveniles are often found together with adults at shallower locations of the continental slope in the summer months.

Adults: Commercial fishery data have consistently indicated that adult Pacific ocean perch are found in aggregations over reasonably smooth, trawlable bottom of the continental slope. Generally, they are found in shallower depths (180-250 m) in the summer, and deeper (300-420 m) in the fall, winter, and early spring. In addition, investigators in the 1960s and 1970s speculated that the fish sometimes inhabited the mid-water environment off bottom and also might be found in rough, untrawlable areas. Hard evidence to support these latter two conjectures, however, has been lacking. The best information available at present suggests that adult Pacific ocean perch is mostly a demersal species that prefers a flat, pebbled substrate along the continental slope. More research is needed, however, before definitive conclusions can be drawn as to its habitat preferences.

Habitat and Biological Associations: Pacific ocean perch

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	Internal incubation: ~90 days	NA	Winter	NA	NA	NA	NA	NA
Larvae	U; assumed between 60 -180 days	U; assumed to be micro-zooplankton	Spring-summer	ICS, MCS, OCS, USP, LSP, BSN	P	NA	U	U
Juveniles	3-6 months to 10 years	early: calanoid copepods late: euphausiids	All year	ICS, MCS, OCS, USP	?P (early juvenile only), D	R (<age 3)	U	U
Adults	10-98 years of age	Euphausiids	Insemination (fall); Fertilization, incubation (winter); Larval release (spring); Feeding in shallower depths (summer)	OCS, USP	D, SD	CB, G,?M, ?SM,?MS	U	U

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D.11 Shortraker Rockfish, Rougheye Rockfish, and Northern Rockfish

D.11.1 Life History and General Distribution

Shortraker and rougheye rockfishes are found along the northwest slope of the eastern Bering Sea, throughout the Aleutian Islands and south to Point Conception, California. Both species are semi-demersal and can be found at depths ranging from 25 to 875 m; however, commercial concentrations usually occur at depths from 100 to 500 m. Though relatively little is known about their biology and life history, both species appear to be K-selected with late maturation, slow growth, extreme longevity, and low natural mortality. Shortraker and rougheye rockfish attain maturity relatively late in life, at about 20+ years of age. Both species are among the largest *Sebastes* species in Alaskan waters, attaining sizes of up to 104 cm for shortraker and 96 cm for rougheye rockfish. Shortraker rockfish have been estimated to attain ages in excess of 120 years and rougheye rockfish in excess of 140 years. Natural mortality for both species is low, estimated to be on the order of 0.01 to 0.04. For shortraker rockfish, length at 50% sexual maturity is about 45 cm and about 44 cm for rougheye rockfish.

Sources of additional distribution data

Larvae:

NMFS, Alaska Fisheries Science Center, FOCI program, Art Kendall, 206-526-4108.

D.11.2 Fishery

Trawl and longline gear are the primary methods of harvest. Even though both species are found to as far south as Point Conception, California, commercial quantities are primarily harvested from northern Washington throughout Alaskan waters. Depths of commercial harvests usually occur from about 100 to 500 m. Both species are associated with a variety of habitats from soft to rocky habitats along the continental slope, although boulders and sloping terrain appear to be a desirable habitat feature for both species. Trawling in such habitats often requires specialized fishing skills to avoid gear damage and to keep the trawl in the proper fishing configuration. Age at recruitment is uncertain, but is probably on the order of 20+ years for both species. Shortraker and rougheye rockfish are often caught as bycatch in trawl and longline fisheries for sablefish and halibut.

D.11.3 Relevant Trophic Information

Shortraker and rougheye rockfishes prey primarily on shrimps, squids, and myctophids. It is uncertain what are the main predators on both species.

D.11.4 Habitat and Biological Associations

Egg/Spawning: The timing of reproductive events is apparently protracted. One study indicated that vitellogenesis was present for four to five months and lasted from about July until late October and November. Parturition apparently occurs mainly in early spring through summer.

Larvae: No information is available regarding the habitats and biological associations of shortraker and rougheye rockfish larvae.

Juveniles: Very little information is available regarding the habitats and biological associations of shortraker and rougheye rockfish juveniles. It is suspected, however, that the juveniles of both species occupy shallower habitats than that of the adults.

Adults: Adults are semi-demersal and can be found at depths ranging from 25 to 875 m. Submersible observations indicate that adults occur over a wide range of habitats. Soft substrates of sand or mud usually had the highest densities; whereas hard substrates of bedrock, cobble or pebble usually had the lowest adult densities. Habitats with steep slopes and frequent boulders were used at a higher rate than habitats with gradual slopes and few boulders.

Habitat and Biological Associations: Shortraker and Rougheye Rockfish

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	U	U	U	U	U	U	U	
Larvae	U	U	Spawning: early spring through summer	U	U	U	U	
Juveniles	U	U; Shrimp & amphipods?	U	U; MCS, OCS?	U	U	U	
Adults	15+ years of age	Shrimp, Squid Myctophids	Year-round?	OCS, USP	SD	M, S, R, SM, CB, MS, G	U	

D.11.5 Literature

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D.12 Thornyheads and Dusky Rockfish

D.12.1 Life History and General Distribution

Thornyheads of the northeastern Pacific Ocean are comprised of two species, the shortspine thornyhead (*Sebastolobus alascanus*) and the longspine thornyhead (*S. altivelis*). The shortspine thornyhead is a demersal species which inhabits deep waters from 93 to 1,460 m from the Bering Sea to Baja California. This species is common throughout the Gulf of Alaska, eastern Bering Sea and Aleutian Islands. The population structure of shortspine thornyheads, however, is not well defined. Thornyheads are slow-growing and long-lived with maximum age in excess of 50 years and maximum size greater than 75 cm and 2 kg. Thornyheads spawn buoyant masses of eggs during the late winter and early spring that resemble bilobate "balloons" which float to the surface. Juvenile shortspine thornyheads have a pelagic period of about 14-15 months and settle out at about 22 to 27 mm. Fifty percent of female shortspine thornyheads are sexually mature at about 21 cm and 12-13 years of age. Female shortspine thornyheads appear to be mature at about 21-22 cm.

Sources of additional distribution data

Larvae:

NMFS, Alaska Fisheries Science Center, FOCI program, Art Kendall, 206-526-4108.

D.12.2 Fishery

Trawl and longline gear are the primary methods of harvest. The bulk of the fishery occurs in late winter or early spring through the summer. In the past, this species was seldom the target of a directed fishery. Today thornyheads are one of the most valuable of the rockfish species, with most of the domestic harvest exported to Japan. Thornyheads are taken with some frequency in the longline fishery for sablefish and cod and is often part of the bycatch of trawlers concentrating on pollock and Pacific ocean perch.

D.12.3 Relevant Trophic Information

Shortspine thornyheads prey mainly on epibenthic shrimp and fish. Cottids were the most important prey item in the Aleutian Islands region (Yang 1996).

D.12.4 Habitat and Biological Associations

Egg/Spawning: Eggs float in masses of various sizes and shapes. Frequently the masses are bilobed with the lobes 15 cm to 61 cm in length, consisting of hollow conical sheaths containing a single layer of eggs in a gelatinous matrix. The masses are transparent and not readily observed in the daylight. Eggs are 1.2 to 1.4 mm in diameter with a 0.2 mm oil globule. They move freely in the matrix. Complete hatching time is unknown but is probably more than 10 days.

Larvae: Three day-old larvae are about 3 mm long and apparently float to the surface. It is believed that the larvae remain in the water column for about 14-15 months before settling to the bottom.

Juveniles: Very little information is available regarding the habitats and biological associations of juvenile shortspine thornyheads.

Adults: Adults are demersal and can be found at depths ranging from about 90 to 1,500 m. Groundfish species commonly associated with thornyheads include: arrowtooth flounder (*Atheresthes stomias*), Pacific ocean perch (*Sebastes alutus*), sablefish *(Anoplopoma fimbria*), rex sole (*Glyptocephalus zachirus*), Dover sole (*Microstomus pacificus*), shortraker rockfish (*Sebastes borealis*), rougheye rockfish (*Sebastes aleutianus*), and grenadiers (family Macrouridae).

Habitat and Biological Associations: Thornyheads

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	U	U	Spawning: late winter, early spring	U	P	U	U	
Larvae	<15 Months	U	early spring - summer	U	P	U	U	
Juveniles	> 15 months (?) when settling to bottom occurs	U; Shrimp, Amphipods, Mysids, Euphausiids?	U	MCS, OCS, USP	D	M, S, R, SM, CB, MS, G	U	
Adults	U	Shrimp, small crabs, fish (cottids)	Year-round?	MCS, OCS, USP, LSP	D	M, S, R, SM, CB, MS, G	U	

D.12.5 Literature

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D.13 Atka mackerel

D.13.1 Life History and General Distribution

Atka mackerel are distributed from the Gulf of Alaska to the Kamchatka Peninsula, most abundant along the Aleutian Islands. Adult Atka mackerel occur in large localized aggregations usually at depths less than 200 m and generally over rough, rocky and uneven bottom near areas where tidal currents are swift. Adults are pelagic during much of the year, but migrate annually to moderately shallow waters where they become demersal during spawning. Spawning peaks in June through September, but may occur intermittently throughout the year. Atka mackerel deposit eggs in nests built and guarded by males on rocky substrates or on kelp in shallow water. Eggs hatch in 40-45 days, releasing planktonic larvae which have been found up

to 800 km from shore. Little is known of the distribution of young Atka mackerel prior to their appearance in trawl surveys and the fishery at about age 2-3 years. Atka mackerel exhibit intermediate life history traits. The approximate upper size limit of Atka mackerel is 35 cm. R-traits include young age at maturity (approximately 50% are mature at age 3), fast growth rates, high natural mortality (M=0.3) and young average and maximum ages (about 5 and 14 years, respectively). K-selected traits include low fecundity (only about 30,000 eggs/female/year, large egg diameters (1-2 mm) and male nest-guarding behavior).

Sources of additional distribution data

Larvae:
NMFS, Alaska Fishery Science Center, FOCI program, Rick Brodeur 206-526-4318

Juveniles:
NMFS, Alaska Fishery Science Center, NMML, Richard Merrick 206-526-6173

D.13.2 Fishery

Bottom trawling and some pelagic trawling, with recruitment at about age 3, are conducted in the Aleutian Islands at depths between about 70-225 m, in trawlable areas on rocky, uneven bottom, along edges, and in lee of submerged hills during periods of high current. Currently, the fishery occurs on reefs west of Kiska Island, south and west of Amchitka Island, in Tanaga Pass and near the Delarof Islands, and south of Seguam and Umnak Islands. Historically, the fishery occurred east into the GOA as far as Kodiak Island (through the mid-1980s), but is no longer there. The fishery used to be entirely during summer, during spawning season; it now occurs throughout the year. It is considered a very "clean" fishery; bycatch of other species is minimal.

D.13.3 Relevant Trophic Information

Atka mackerel is important food for Steller sea lions in the Aleutian Islands, particularly during summer, and for other marine mammals (minke whales, Dall's porpoise and northern fur seal). Juveniles are eaten by thick billed murres and tufted puffins. Main groundfish predators are Pacific halibut, arrowtooth flounder, and Pacific cod.

D.13.4 Habitat and Biological Associations

Egg/Spawning: Eggs deposited in nests built and guarded by males on rocky substrates or on kelp in shallow water.

Larvae/Juveniles: Planktonic larvae have been found up to 800 km from shore, usually in upper water column (neuston), but little is known of the distribution of Atka mackerel until they are about 2 years old and appear in fishery and surveys.

Adults: Adults occur in localized aggregations usually at depths less than 200 m and generally over rough, rocky and uneven bottom near areas where tidal currents are swift. Adults are semi-demersal/pelagic during much of the year, but migrate annually to moderately shallow waters where the males become demersal during spawning; females move between nesting and offshore feeding areas.

Habitat and Biological Associations: Atka mackerel

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	40-45 days	NA	summer	IP, ICS	D	G, R, K	U	develop 3-20˚C optimum 9-13˚C
Larvae	up to 6 months	U copepods?	fall-winter	U	U N?	U	U	2-12˚C optimum 5-7˚C
Juveniles	½-2 years	U; copepods, euphausiids?	all year	U	U	U	U	3-5˚C
Adults	3+ years	copepods, euphausiids, meso-pelagic fish (myctophids)	spawning May-Oct non-spawning Nov-Apr tidal/diurnal, year-round?	ICS, MCS, IP MCS, OCS, IP ICS, MCS, OCS, IP	D (males) SD (females) SD/D all sexes D when currents high/day; SD when slack tides/ night	G, R, K	F, E	3-5˚C all stages >17 ppt only

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D.14 Squid

The species representatives for squid are:

Gonaditae:	Red or magistrate armhook squid (*Berryteuthis magister*)
Onychoteuthidae:	Boreal clubhook squid (*Onychoteuthis banksii borealjaponicus)*
	Giant or robust clubhook squid (*Moroteuthis robusta*)
Sepiolidae:	eastern Pacific bobtail squid (*Rossia pacifica*)

D.14.1 Life History and General Distribution:

Squid are members of the molluscan class Cephalopoda, along with octopus, cuttlefish and nautiloids. In the BSAI and GOA, gonatid and onychoteuthid squids are generally the most common, along with chiroteuthids. All cephalopods are stenohaline, occurring only at salinities > 30 ppt. Fertilization is internal, and development is direct (“larval” stages are only small versions of adults). The eggs of inshore neritic species are often enveloped in a gelatinous matrix attached to rocks, shells or other hard substrates, while the eggs

of some offshore oceanic species are extruded as large, sausage-shaped drifting masses. Little is known of the seasonality of reproduction, but most species probably breed in spring-early summer, with eggs hatching during the summer. Most small squid are generally thought to live only 2-3 years, but the giant *Moroteuthis robusta* clearly lives longer.

B magister: widely distributed in the boreal north Pacific from California, throughout the Bering Sea, to Japan in waters of depth 30-1500 m; adults most often found at mesopelagic depths or near bottom on shelf, rising to the surface at night; juveniles are widely distributed across shelf, slope and abyssal waters in meso- and epipelagic zones, and rise to surface at night. The species migrates seasonally, moving northward and inshore in summer, and southward and offshore in winter, particularly in the western north Pacific. The upper size limit of juvenile fish for *B. magister* is approximately 20 cm mantle length for males, 25 cm mantle length for females; both at approximately 1 year of age.The maximum size for females is 50 cm mantle length and for males is 40 cm mantle length. Spermatophores transferred into the mantle cavity of female, and eggs are laid on the bottom on the upper slope (200-800 m). Fecundity is estimated at 10,000 eggs/female. Spawning of eggs occurs in Feb-Mar in Japan, but apparently all year-round in the Bering Sea. Eggs hatch after 1-2 months of incubation; development is direct. Adults are gregarious prior to mating, and most die afterwards.

O. banksii borealjaponicus: an active, epipelagic species, distributed in the north Pacific from the Sea of Japan, throughout the Aleutian Islands and south to California, but is absent from the Sea of Okhotsk and not common in the Bering Sea. Juveniles can be found over shelf waters at all depths and near shore. Adults apparently prefer the upper layers over slope and abyssal waters; diel migrators and gregarious. Development includes a larval stage; maximum size is about 55 cm.

M. robusta: a giant squid, lives near the bottom on the slope, and mesopelagically over abyssal waters; rare on the shelf. It is distributed in all oceans, and is found in the Bering Sea, Aleutian Islands and Gulf of Alaska. Mantle length can be up to 2.5 m long; with tentacles at least 7 m, but most are about 2 m long.

R. pacifica: a small (maximum length with tentacles of less than 20 cm) demersal, neritic and shelf, boreal species, distributed from Japan to California in the North Pacific and in the Bering Sea in waters of about 20-300 m depth. Other *Rossia* spp. deposit demersal egg masses.

Source of additional information

Beth Sinclair, NMFS, Seattle, WA 206-526-6466

D.14.2 Fishery

Not currently a target of groundfish fisheries of BSAI. A Japanese fishery catching up to 9,000 mt of squid annually existed until the early 1980s for *B. magister* in the Bering Sea and *O. banksii borealjaponicus* in the Aleutian Islands. Since 1990, annual squid bycatch has been about 1,000 mt or less in the BSAI; almost all squid bycatch is in the midwater pollock fishery near the continental shelf break and slope.

D.14.3 Relevant Trophic Information

The principal prey items of squid are small forage fish pelagic crustaceans (e.g., euphausiids and shrimp), and other cephalopods; cannibalism is not uncommon. After hatching, small planktonic zooplankton (copepods) are eaten. Squid are preyed upon by marine mammals, seabirds, and, to a lesser extent by fish, and occupy an important role in marine food webs worldwide. Perez (1990) estimated that squids comprise over 80% of the diets of sperm whales, bottlenose whales and beaked whales, and about half of the diet of Dall's porpoise in the eastern Bering Sea and Aleutian Islands. Seabirds (e.g., kittiwakes, puffins, murres) on island rookeries close to the shelf break (e.g., Buldir Island, Pribilof Islands) are also known to feed heavily on squid (Hatch et al. 1990; Byrd et al. 1992; Springer 1993). Squid play a larger role in the diet of salmon (Livingston and Goiney 1983).

D.14.4 Habitat and Biological Associations for *B. magister*

Egg/Spawning: Eggs are laid on the bottom on the upper slope (200-800 m); incubate for 1-2 months.

Young Juveniles: Distributed epipelagically (top 100 m) from the coast to open ocean.

Old Juveniles and Adults: Distributed mesopelagically (most from 150-500 m) on the shelf (summer only?), but mostly in outer shelf/slope waters (to lesser extent over the open ocean). Migrate to slope waters to mate and spawn demersally.

Habitat and Biological Associations: *Berryteuthis magister* (red squid)

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	1-2 months	NA	varies	USP, LSP	D	M, SM, MS	U	
Young juveniles	4-6 months	zooplankton		All shelf, slope, BSN	P, N	NA	UP, F?	
Older Juveniles and Adults	1-2 years (may be up to 4 years)	euphausiids, shrimp, small forage fish, and other cephalopods	summer winter	All shelf, USP, LSP, BSN OS, USP, LSP, BSN	SP SP	U U	UP, F? UP, F?	Euhaline waters, 2-4°C

D.14.5 Literature

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D.15 Capelin

The species representative for capelin is *Mallotus villosus*.

D.15.1 Life History and General Distribution

Capelin is a short-lived marine (neritic), pelagic, filter-feeding schooling fish distributed along the entire coastline of Alaska and the Bering Sea, and south along British Columbia to the Strait of Juan de Fuca; they are circumpolar. In the North Pacific, capelin grow to a maximum of 25 cm and 5 years of age. They spawn at ages 2-4 in spring and summer (May-Aug – earlier in south, later in north) when about 11-17 cm, on coarse sand/fine gravel beaches, especially in Norton Sound, northern Bristol Bay, and along the Alaska Peninsula. Age at 50% maturity is 2 years. The approximate upper size limit of juvenile capelin is 13 cm. Their level of fecundity is 10,000-15,000 eggs per female. Eggs hatch in 2-3 weeks. Most capelin (60-70%) die after spawning. Larvae and juveniles are distributed on inner-mid shelf in summer (rarely found in waters deeper than about 200 m), and juveniles and adults congregate in fall in mid-shelf waters east of the Pribilof Islands, west of St. Matthew and St. Lawrence Islands, and north into the Gulf of Anadyr. Distributed along outer shelf and under ice edge in winter. Larvae, juveniles and adults have diurnal vertical migrations following scattering layers - night near surface, at depth during the day. Smelts are captured during trawl surveys, but their patchy distribution both in space and time reduces the validity of biomass estimates.

Sources of additional distribution data

Paul Anderson, NMFS/RACE, Kodiak AK 907-487-4961
Jim Blackburn, ADFG, Kodiak AK 907-486-1861

D.15.2 Fishery

Capelin are not a target species in groundfish fisheries of the BSAI, but caught as bycatch (up to several hundred tons per year in the 1990s) principally by the yellowfin sole trawl fishery in Kuskokwim and Togiak Bays in spring in BSAI; almost all is discarded. Small local coastal fisheries occur in spring and summer.

D.15.3 Relevant Trophic Information

Capelin are important prey for marine birds and mammals as well as other fish. Surface feeding (e.g., gulls and kittiwakes), as well as shallow and deep diving piscivorous birds (e.g., murres and puffins) largely consume small schooling fishes such as capelin, eulachon, herring, sand lance and juvenile pollock (Hunt et al. 1981a; Sanger 1983). Both pinnipeds (Steller sea lions, northern fur seals, harbor seals, and ice seals) and cetaceans (such as harbor porpoise, and fin, sei, humpback, beluga whales) feed on smelts, which may provide an important seasonal food source near the ice-edge in winter, and as they assemble nearshore in spring to spawn (Frost and Lowry 1987; Wespestad 1987). Smelts also comprise significant portions of the diets of some commercially exploited fish species, such as Pacific cod, walleye pollock, arrowtooth flounder, Pacific halibut, sablefish, Greenland turbot and salmon, throughout the North Pacific Ocean and the Bering Sea (Allen 1987).

D.15.4 Habitat and Biological Associations

Egg/Spawning: Spawn adhesive eggs (about 1 mm in diameter) on fine gravel or coarse sand (0.5-1 mm grain size) beaches intertidally to depths of up to 10 m in May-July in Alaska (later to the north in Norton Sound). Hatching occurs in 2-3 weeks. Most intense spawning when coastal water temperatures are 5-9˚C.

Larvae: After hatching, 4-5 mm larvae remain on the middle-inner shelf in summer; distributed pelagically; centers of distribution are unknown, but have been found in high concentrations north of Unimak Island.

Juveniles: In fall, juveniles are distributed pelagically in mid-shelf waters (50-100 m depth; -2-3˚C), and have been found in highest concentrations east of the Pribilof Islands, west of St. Matthew and St. Lawrence Islands and north into the Gulf of Anadyr.

Adults: Found in pelagic schools in inner-mid shelf in spring-fall, feed along semi-permanent fronts separating inner, mid, and outer shelf regions (~50 and 100 m). In winter, found in concentrations under ice-edge and along mid-outer shelf.

Habitat and Biological Associations: Capelin

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	2-3 weeks to hatch	NA	May-August	BCH (to 10 m)	D	S, CB		5-9˚C peak spawning
Larvae	4-8 months?	Copepods phytoplankton	summer/fall/ winter	ICS, MCS	N, P	U NA?	U	
Juveniles	1.5+ years up to age 2	Copepods Euphausiids	all year	ICS, MCS	P	U NA?	U; F?; Ice edge in winter	
Adults	2 years ages 2-4+	Copepods, Euphausiids, polychaetes, small fish	spawning May-Aug non-spawning Sep-Apr	BCH (to 10 m) ICS, MCS, OCS	D, SD P	S, CB NA?	F; Ice edge in winter	-2 - 3˚C Peak distributions in Bering Sea?

D.15.5 Literature

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D.16 Eulachon

The species representative for eulachon is the candlefish *(Thaleichthys pacificus*).

D.16.1 Life History and General Distribution

Eulachon is a short-lived anadromous, pelagic schooling fish distributed from the Pribilof Islands in the eastern Bering Sea, throughout the Gulf of Alaska, and south to California. They are consistently found pelagically in Shelikof Strait (hydroacoustic surveys in late winter-spring) and between Unimak Island and the Pribilof Islands (bycatch in groundfish trawl fisheries) from the middle shelf to over the slope. In the North Pacific, eulachon grow to a maximum of 23 cm and 5 years of age. They spawn at ages 3-5 in spring and early summer (April-June) when about 14-20 cm in rivers on coarse sandy bottom. Age at 50% maturity is 3 years. The approximate upper size limit of is 14 cm. Fecundity is approximately 25,000 eggs per female. Eggs adhere to sand grains and other substrates on river bottom. Eggs hatch in 30-40 days in BC at 4-7˚C. Most eulachon die after first spawning. Larvae drift out of rivers and develop at sea. Smelts are captured during trawl surveys, but their patchy distribution both in space and time reduces the validity of biomass estimates.

Sources of Additional Data

Paul Anderson, NMFS/RACE, Kodiak AK 907-487-4961
Jim Blackburn, ADFG, Kodiak AK 907-486-1861

D.16.2 Fishery

Eulachon are not a target species in groundfish fisheries of the BSAI, but caught as bycatch (up to several hundred tons per year in the 1990s) principally by midwater pollock fisheries between the Pribilof Islands and Unimak Island on the outer continental shelf and slope; almost all are discarded. Small local coastal fisheries occur in spring and summer.

D.16.3 Relevant Trophic Information

Eulachon may be important prey for marine birds and mammals, as well as other fish. Surface feeding (e.g., gulls and kittiwakes), as well as shallow and deep diving piscivorous birds (e.g., murres and puffins) largely consume small schooling fishes such as capelin, eulachon, herring, sand lance and juvenile pollock (Hunt et al. 1981a; Sanger 1983). Both pinnipeds (Steller sea lions, northern fur seals, harbor seals, and ice seals) and cetaceans (such as harbor porpoise, and fin, sei, humpback, beluga whales) feed on smelts, which may provide an important seasonal food source near the ice-edge in winter, and as they assemble nearshore in spring to spawn (Frost and Lowry 1987; Wespestad 1987). Smelts also comprise significant portions of the diets of some commercially exploited fish species, such as Pacific cod, walleye pollock, arrowtooth flounder, Pacific halibut, sablefish, Greenland turbot and salmon, throughout the North Pacific Ocean and the Bering Sea (Allen 1987).

D.16.4 Habitat and Biological Associations

Egg/Spawning: Anadromous; return to spawn in spring (May-June) in rivers; demersal eggs adhere to bottom substrate (sand, cobble, etc.). Hatching occurs in 30-40 days.

Larvae: After hatching, 5-7 mm larvae drift out of river and develop pelagically in coastal marine waters; centers of distribution are unknown.

Juveniles and Adults: Distributed pelagically in mid-shelf to upper slope waters (50-1000 m water depth), and have been found in highest concentrations between the Pribilof Islands and Unimak Island on the outer shelf, and in Shelikof east of the Pribilof Islands, west of St. Matthew and St. Lawrence Islands and north into the Gulf of Anadyr.

Habitat and Biological Associations: Eulachon (Candlefish)

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	30-40 days	NA	Apr-Jun	Rivers, FW	D	S (CB?)		4-8˚C for egg development
Larvae	1-2 months?	Copepods, phytoplankton, mysids, larvae	summer/fall	ICS ?	P?	U NA?	U	
Juveniles	2.5+ years up to age 3	Copepods, Euphausiids	all year	MCS, OCS, USP	P	U NA?	U F?	
Adults	3 years ages 3-5+	Copepods, Euphausiids	spawning: May-Jun non-spawning: Jul-Apr	Rivers-FW MCS, OCS, USP	D P	S (CB?) NA?	F?	

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D.17 Sculpins

The species representatives for sculpins are:

Yellow Irish lord (*Hemilepidotus jordani)*

Red Irish lord (*Hemilepidotus hemilepidotus*)

Butterfly sculpin (*Hemilepidotus papilio*)

Bigmouth sculpin (*Hemitripterus bolini*)

Great sculpin (*Myoxocephalus polyacanthocephalus*)

Plain sculpin (*Myoxocephalus jaok*)

D.17.1 Life History and General Distribution

The Cottidae (sculpins) is a large circumboreal family of demersal fishes inhabiting a wide range of habitats in the north Pacific Ocean and Bering Sea. Most species live in shallow water or in tidepools, but some inhabit the deeper waters (to 1000 m) of the continental shelf and slope. Most species do not attain a large size (generally 10-15 cm), but those that live on the continental shelf and are caught by fisheries can be 30-50 cm; the cabezon is the largest sculpin and can be as long as 100 cm. The upper size limit of juvenile fish is unknown. Most sculpins spawn in the winter. All species lay eggs, but in some genera, fertilization is internal. The female commonly lays demersal eggs amongst rocks where they are guarded by males. Egg incubation duration is unknown; larvae were found across broad areas of the shelf and slope, and were found all year-round, in ichthyoplankton collections from the southeast Bering Sea. Larvae exhibit diel vertical migration (near surface at night and at depth during the day). Sculpins generally eat small invertebrates (e.g., crabs, barnacles, mussels), but fish are included in the diet of larger species; larvae eat copepods.

Yellow Irish lords: distributed from subtidal areas near shore to the edge of the continental shelf (down to 200 m) throughout the Bering Sea, Aleutian Islands, and eastward into the GOA as far as Sitka, AK; up to 40 cm in length.

Red Irish lords: distributed from rocky, intertidal areas to about 100 m depth on the middle continental shelf (most shallower than 50 m), from California (Monterey Bay) to Kamchatka; throughout the Bering Sea and Gulf of Alaska; rarely over 30 cm in length. Spawns masses of pink eggs in shallow water or intertidally.

Butterfly sculpins: distributed primarily in the western north Pacific and northern Bering Sea, from Hokkaido, Japan, Sea of Okhotsk, Chukchi Sea, to southeast Bering Sea and in Aleutian Islands; depths of 20-250 m, most frequent 50-100 m.

Bigmouth sculpin: distributed in deeper waters offshore, between about 100-300 m in the Bering Sea, Aleutian Islands, and throughout the Gulf of Alaska; up to 70 cm in length.

Great sculpin: distributed from the intertidal to 200 m, but may be most common on sand and muddy/sand bottoms in moderate depths (50-100 m); up to 80 cm in length. Found throughout the Bering Sea, Aleutian Islands, and Gulf of Alaska, but may be less common east of Prince William Sound.

Plain sculpin: distributed throughout the Bering Sea and Gulf of Alaska (not common in the Aleutian Islands) from intertidal areas to depths of about 100 m, but most common in shallow waters (<50 m); up to 50 cm in length. *Myoxocephalus* spp. larvae ranged in length from 9-16 mm in spring ichthyoplankton collections in the western GOA.

Sources for Additional Data

Paul Anderson, NMFS/RACE, Kodiak AK 907-487-4961
Jim Blackburn, ADFG, Kodiak AK 907-486-1861

D.17.2 Fishery

Sculpins are not a target of groundfish fisheries of the BSAI, but sculpin bycatch (second to skates in weight amongst the Other Species) has ranged from 6,000-11,000 mt per year from 1992-95. Bycatch occurs principally in bottom trawl fisheries for flatfish, Pacific cod and pollock, but also while longlining for Pacific cod; almost all is discarded. Annual sculpin bycatch in the BSAI ranges between 1-4% of annual survey biomass estimates, however little is known of the species distribution of the bycatch.

D.17.3 Relevant Trophic Information

Sculpins feed on bottom invertebrates (e.g., crabs, barnacles, mussels and other molluscs); larger species eat fish.

D.17.4 Habitat and Biological Associations

Egg/Spawning: Lay demersal eggs in nests guarded by males; many species in rocky shallow waters near shore.

Larvae: Distributed pelagically and in neuston across broad areas of shelf and slope, but predominantly on inner and middle shelf; have been found all year-round.

Juveniles and Adults: Sculpins are demersal fish, and live in a broad range of habitats from rocky intertidal pools to muddy bottoms of the continental shelf, and rocky, upper slope areas. Most commercial bycatch occurs on middle and outer shelf areas used by bottom trawlers for Pacific cod and flatfish.

Habitat and Biological Associations: Sculpins

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	U	NA	winter?	BCH, ICS (MCS, OCS?)	D	R (others?)	U	
Larvae	U	copepods	all year?	ICS, MCS, OCS, USP	N, P	NA?	U	
Juveniles and Adults	U	bottom invertebrates (crabs, molluscs, barnacles) and small fish	all year	BCH, ICS, MCS, OCS, UPS	D	R, S, M, SM	U	

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D.18 Sharks

The species representatives for sharks are:

Lamnidae: Salmon shark (*Lamna ditropis*)

Squalidae: Sleeper shark (*Somniosus pacificus*)
Spiny dogfish (*Squalus acanthias*)

D.18.1 Life History and General Distribution

Sharks of the order Squaliformes (which includes the two families Lamnidae and Squalidae) are the higher sharks with five gill slits and two dorsal fins. The Lamnidae are large, ovoviviparous (with small litters, 1-4; embryos nourished by intrauterine cannibalism), widely migrating sharks that are highly aggressive predators

(salmon and white sharks). The Lamnidae are partly warm-blooded; the heavy trunk muscles are warmer than water for greater power and efficiency.

Salmon sharks are distributed epipelagically along the shelf (can be found in shallow waters) from California through the Gulf of Alaska (where they occur all year and are probably most abundant in our area), the Bering Sea and off Japan. In groundfish fishery and survey data, they occur chiefly on outer shelf/upper slope areas in the Bering Sea. The sharks are not commonly seen in Aleutian Islands. Upper size limit of juvenile salmon sharks is not known. Adults can be up to 3 m in length.

The Pacific sleeper shark is distributed from California around the Pacific rim to Japan and in the Bering Sea principally on the outer shelf and upper slope (but has been observed nearshore), generally demersal (but also seen near surface). Other members of the Squalidae are ovoviviparous, but fertilization and development of sleeper sharks are not known; adults are up to 8 m in length. In groundfish fishery and survey data, they occur chiefly on outer shelf/upper slope areas in the Bering Sea. Upper size limit of juvenile sleeper sharks is not known.

Spiny dogfish (or closely related species?) are widely distributed through the Atlantic, Pacific and Indian Oceans. In the north Pacific, they are common in the Bering Sea. They are a pelagic species, found at surface and to depths of 700 m; mostly 200 m or less on shelf and neritic, they are often found in aggregations. Spiny dogfish are oviviparous, with litter size proportional to size of female, from 2-9; gestation may be 22-24 months. Young are 24-30 cm at birth, with growth initially rapid, then slowing dramatically. Maximum adult size is about 1.6 m, and 10 kg; maximum age about 40 years. 50% of females are mature at 94 cm and 29 years old; males, at 72 cm and 19 years old. Females give birth in shallow coastal waters, usually in Sept-Jan. Tagging experiments indicate local indigenous populations in some areas and widely migrating groups in others. May move inshore in summer and offshore in winter.

Source of Additional Data

William Raschi, Bucknell University

D.18.2 Fishery

Sharks are not a target of groundfish fisheries of the BSAI, but shark bycatch has ranged from 300-700 mt per year from 1992-95 principally by pelagic trawl fishery for pollock, longline fisheries for Pacific cod and sablefish, and bottom trawl fisheries for pollock, flatfish and cod; almost all discarded. Little is known of shark biomass in the BSAI.

D.18.3 Relevant Trophic Information

Salmon sharks are believed to eat primarily fish, including salmon, sculpins and gadids. Pacific sleeper sharks are voracious, omnivorous predators of flatfish, cephalopods, rockfish, crabs, seals, salmon; they may also prey on pinnipeds. Dogfish eat a wide variety of foods, including fish (smelts, herring, sand lance, and other small schooling fish), crustaceans (crabs, euphausiids, shrimp), and cephalopods (octopus).

D.18.4 Habitat and Biological Associations

Egg/Spawning: Salmon sharks and spiny dogfish are ovoviviparous; reproductive strategy of sleeper sharks is not known. Spiny dogfish give birth in shallow coastal waters, while salmon sharks probably offshore and pelagic.

Juveniles and Adults: Spiny dogfish are widely dispersed throughout the water column along outer shelf in the Bering Sea; apparently not as commonly found in the Aleutian Islands and not commonly at depths > 200 m. Salmon sharks are less common in the Bering Sea and Aleutian Islands; epipelagic, primarily over the outer shelf in the Bering Sea. Sleeper sharks are widely dispersed along the outer shelf and upper slope in the Bering Sea; generally demersal, and may be less commonly found in the Aleutian Islands.

Habitat and Biological Associations: Sharks

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Juvenile/Adults:								
Salmon shark	U	fish (salmon, sculpins, gadids)	all year	OCS, USP	P	NA	U	
Sleeper shark	U	omnivorous: flatfish, cephalopods, rockfish, crabs, seals, salmon, pinnipeds	all year	OCS, USP	D	U	U	
Spiny dogfish	40 years	fish (smelts, herring, sand lance, other small schooling fish), crustaceans (crabs, euphausiids, shrimp), cephalopods (octopus)	all year	OCS; give birth ICS in fall/winter?	P	U	U	Euhaline 4-16˚C

D.18.5 Literature

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D.19 Skates

The species representatives for skates are:

Alaska skate (*Bathyraja parmifera*)

Aleutian skate (*Bathyraja aleutica*)

Bering skate (*Bathyraja interrupta*)

D.19.1 Life History and General Distribution:

Skates (Rajidae) that occur in the BSAI are grouped into two genera: *Bathyraja* sp., or soft-nosed species (rostral cartilage slender and snout soft and flexible), and *Raja* sp., or hard-nosed species (rostral cartilage is thick making the snout rigid). Skates are oviparous; fertilization is internal and eggs (one to five or more in each case) are deposited in horny cases for incubation. Adults and juveniles are demersal, and feed on bottom invertebrates and fish. Adult distributions from the survey are: Alaska skate: mostly 50-200 m on shelf in the eastern Bering Sea and Aleutian Islands; Aleutian skate: throughout the eastern Bering Sea and Aleutian Islands; Bering Skate: throughout eastern Bering Sea, less common in the Aleutian Islands, mostly 100-350 m. Little is known of their habitat requirements for growth or reproduction, nor of any seasonal movements. BSAI skate biomass estimate more than doubled between 1982-96 from bottom trawl survey; remained stable in the Aleutian Islands in the 1980s. Upper size limit of juvenile skates is unknown.

Source of Additional Data

William Raschi, Bucknell University

D.19.2 Fishery

Skates are not a target of groundfish fisheries of the BSAI, but are caught as bycatch, 13,000-17,000 mt per year from 1992-95, principally by the longline Pacific cod and bottom trawl pollock and flatfish fisheries; almost all discarded. Skate bycatches in the eastern Bering Sea groundfish fisheries ranged between 1-4% of the annual eastern Bering Sea trawl survey biomass estimates in 1992-95.

D.19.3 Relevant Trophic Information

Feed on bottom invertebrates (crustaceans, molluscs, and polychaetes) and fish.

D.19.4 Habitat and Biological Associations

Egg/Spawning: Deposit eggs in horny cases on shelf and slope.

Juveniles and Adults: After hatching, juveniles probably remain in shelf and slope waters, but distribution is unknown. Adults found across wide areas of shelf and slope; surveys found most skates at depths <500 m in the eastern Bering Sea, but >500 m in the Aleutian Islands.

Habitat and Biological Associations: Skates

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceanographic Features	Other
Eggs	U	NA	U	MCS, OCS, USP	D	U	U	
Larvae	NA	NA	NA	NA	NA	NA	NA	
Juveniles	U	Invertebrates small fish	all year	MCS, OCS, USP	D	U	U	
Adults	U	Invertebrates small fish	all year	MCS, OCS, USP	D	U	U	

D.19.5 Literature

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D.20 Octopus

The species representatives for octopus are:

Octopoda: Octopus *(Octopus gilbertianus; O. dofleini*)

Vampyromorpha: Pelagic octopus (*Vampyroteuthis infernalis*)

D.20.1 Life History and General Distribution

Octopus are members of the molluscan class Cephalopoda, along with squid, cuttlefish and nautiloids. In the BSAI, the most commonly encountered octopods are the shelf demersal species *O. gilbertianus* and *O. dofleini*, and the bathypelagic finned species, *V. infernalis*. Octopods, like other cephalopods are dioecious, with fertilization of eggs (usually within the mantle cavity of the female) requiring transfer of spermatophores during copulation. Octopods probably do not live longer than about 2-4 years, and females of some species (e.g., *O. vulgaris*) die after brooding their eggs on the bottom.

O. gilbertianus: Medium sized octopus (up to 2 m in total length) distributed across the shelf (to 500 m depth) in the eastern and western Bering Sea (where it is the most common octopus), Aleutian Islands, and Gulf of Alaska (endemic to the North Pacific). Little is known of its reproductive or trophic ecology, but eggs laid on the bottom and tended by females. Lives mainly among rocks and stones.

O. dofleini: Giant octopus (up to 10 m in total length, though mostly about 3-5 m) distributed in the southern boreal region from Japan and Korea, through the Aleutian Islands, Gulf Alaska, and south along the Pacific coast of North America to California. Inhabits the sublittoral to upper slope. Egg length 6-8 mm; laid on bottom. Copulation may occur in late fall-winter, with oviposition the following spring; each female lays several hundred eggs.

V. infernalis: Relatively small (up to about 40 cm total length) bathypelagic species, living at depths well below the thermocline; may be most commonly found at 700-1500 m. Found throughout the world's oceans. Eggs are large (3-4 mm in diameter) and are shed singly into the water. Hatched juveniles resemble adults, but with different fin arrangements,

which change to the adult form with development. Little is known of their food habits, longevity, or abundance.

D.20.2 Fishery

Octopods are not currently a target of groundfish fisheries of BSAI. Bycatch has ranged between 200-1,000 mt in the BSAI, chiefly in the pot fishery for Pacific cod and bottom trawl fisheries for cod and flatfish, but sometimes in the pelagic trawl pollock fishery. Directed octopus landings have been less than 8 mt/year for 1988-95. Age and size at 50% recruitment is unknown. Most of the bycatch occurs on the outer continental shelf (100-200 m depth), chiefly north of the Alaskan peninsula from Unimak I. to Port Moller and northwest to the Pribilof Islands; also around many of the Aleutian Islands.

D.20.3 Relevant Trophic Information

Octopus are eaten by pinnipeds (principally Steller sea lions, and spotted, bearded, and harbor seals) and a variety of fishes, including Pacific halibut and Pacific cod. When small, octopods eat planktonic and small benthic crustaceans (mysids, amphipods, copepods). As adults, octopus eat benthic crustaceans (crabs) and molluscs (clams).

D.20.4 Habitat and Biological Associations

Egg/Spawning: shelf; eggs laid on bottom, maybe preferentially among rocks and cobble.

Young Juveniles: semi-demersal; widely dispersed on shelf, upper slope

Old Juveniles and Adults: demersal, widely dispersed on shelf and upper slope, preferentially among rocks, cobble, but also on sand/mud.

Habitat and Biological Associations: *Octopus dofleini*, *O. gilbertianus*

Stage - EFH Level	Duration or Age	Diet/Prey	Season/ Time	Location	Water Column	Bottom Type	Oceano-graphic Features	Other
Eggs	U; (1-2 months?)	NA	spring-summer?	U; (ICS, MCS?)	D	R, G?	U	Euhaline waters
Young juveniles	U	zooplankton	summer-fall?	U; (ICS, MCS, OCS, USP?)	D, SD	U	U	Euhaline waters
Older Juveniles and Adults	U ; (2-3 years? for *O.gilbertianus*; older for *O.dofleini*)	crustaceans, molluscs	all year	ICS, MCS, OCS, USP	D	R, G, S, MS?	U	Euhaline waters

D.20.5 Literature

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Appendix E Maps of Essential Fish Habitat

Maps of essential fish habitat (EFH) are included in this section for the following species (life stage is indicated in parentheses):

Walleye pollock (eggs)

Walleye pollock (larvae)

Walleye pollock (juveniles)

Walleye pollock (adults)

Pacific cod (adults and late juveniles)

Yellowfin sole (adults and late juveniles)

Greenland turbot (adults and late juveniles)

Arrowtooth flounder (adults and late juveniles)

Rock sole (adults and late juveniles)

Alaska plaice (adults and late juveniles)

Flathead sole (adults and late juveniles)

Sablefish (adults and late juveniles)

Pacific ocean perch (adults and late juveniles)

Shortraker and Rougheye rockfish (adults and late juveniles)

Northern rockfish (adults and late juveniles)

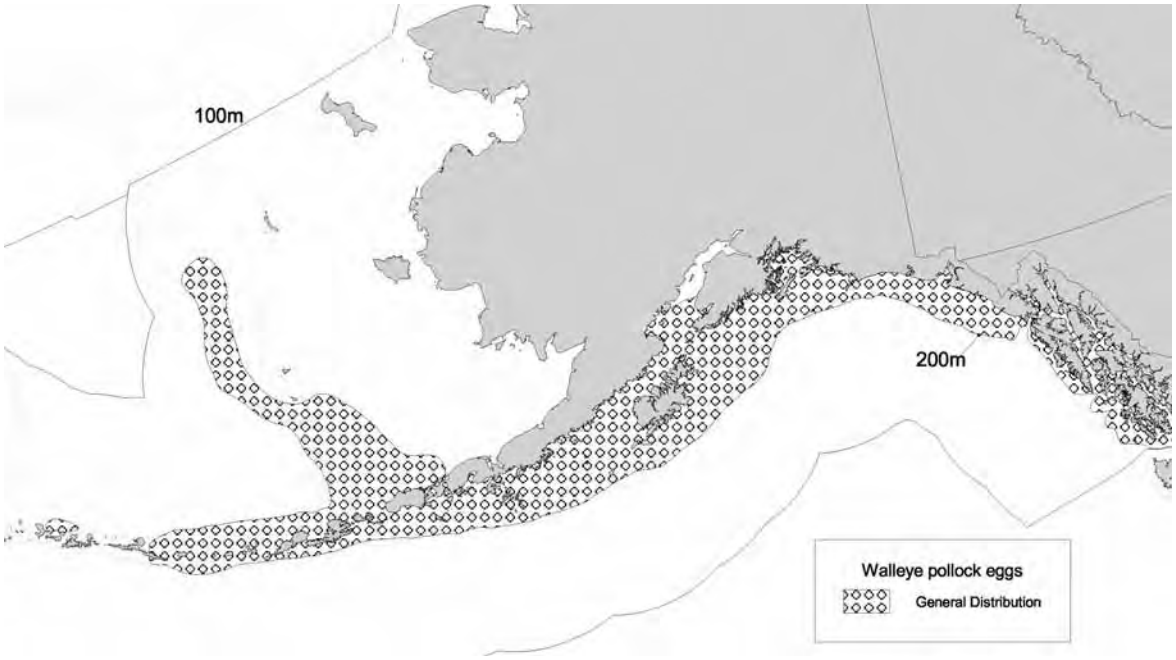
Dusky rockfish (adults and late juveniles)

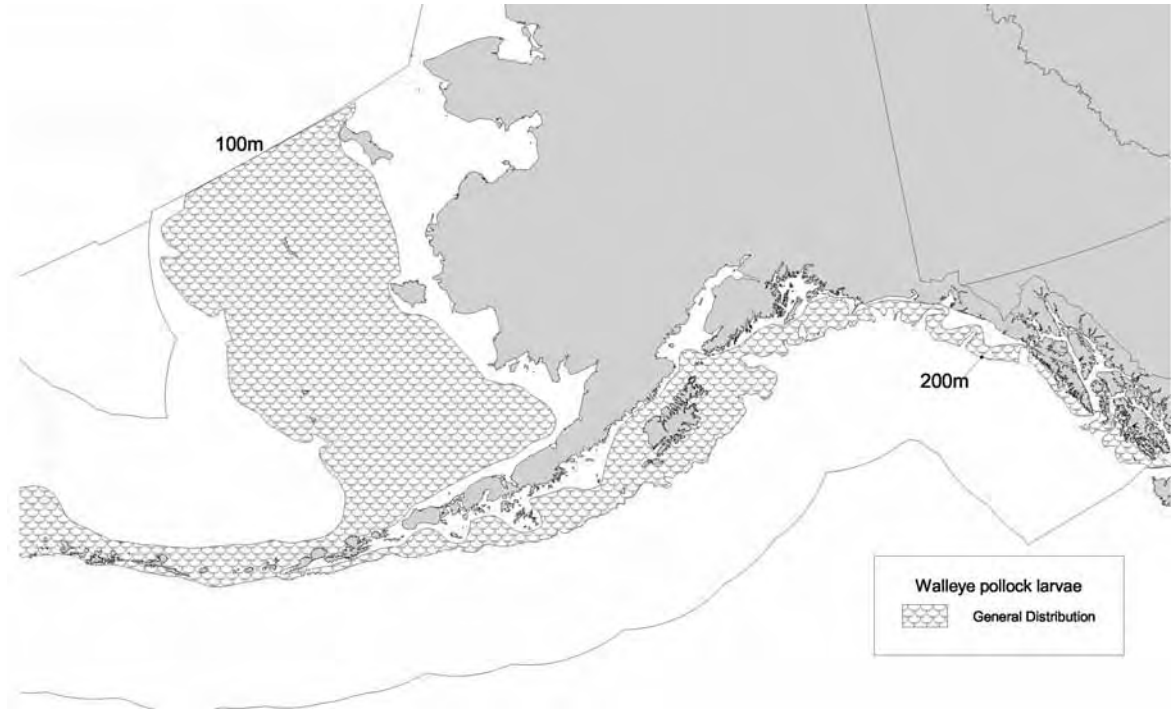
Thornyhead rockfish (adults and late juveniles)

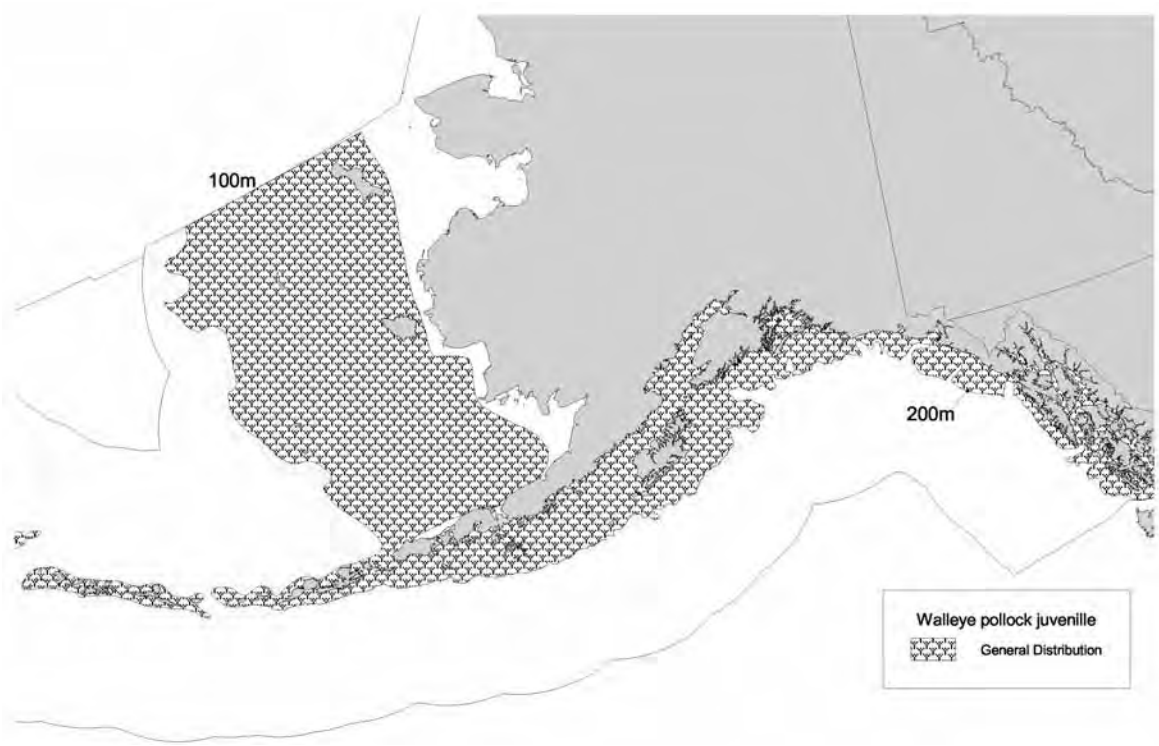
Atka mackerel (adults and late juveniles)

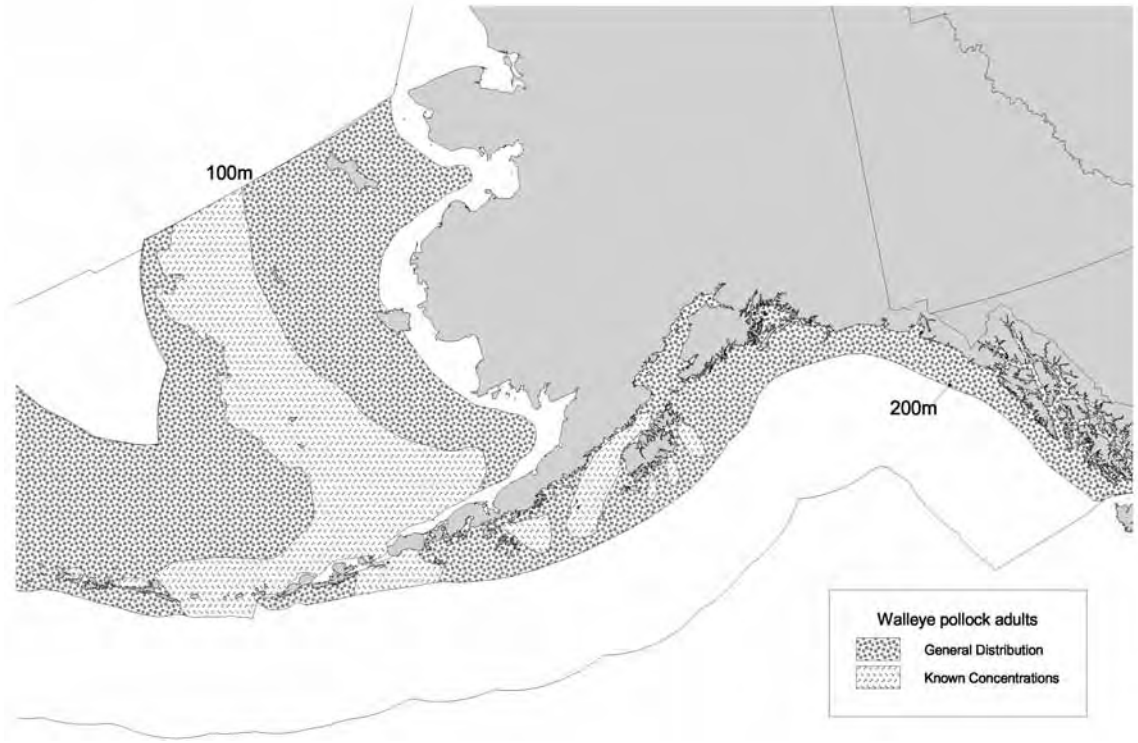
Sculpins species (adults and late juveniles)

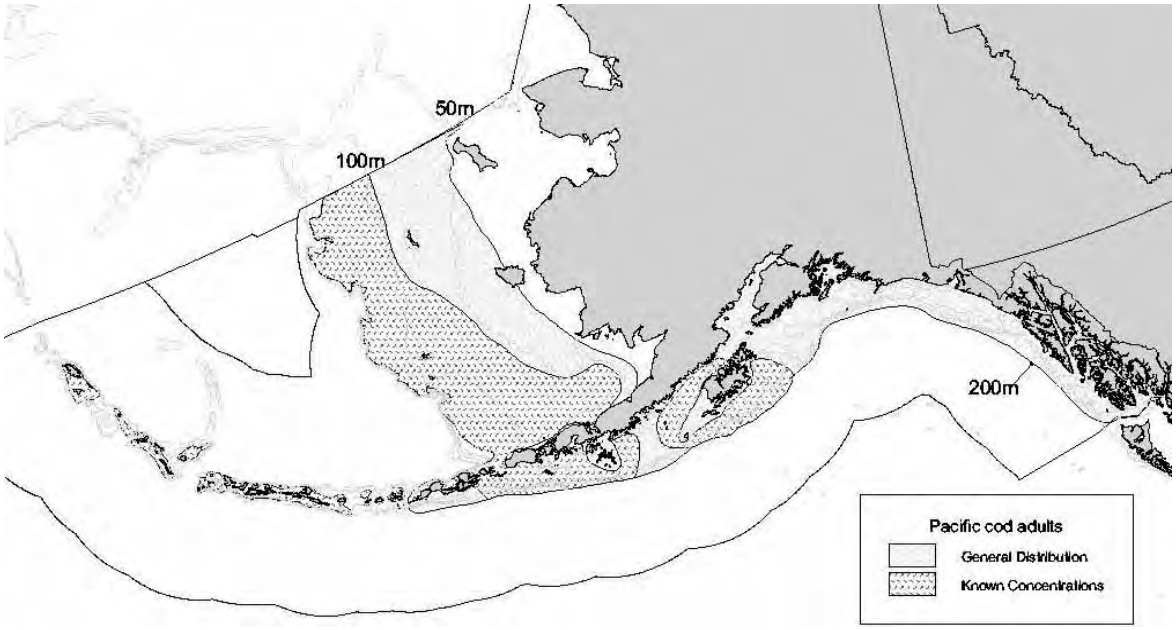
Skates species (adults and late juveniles)

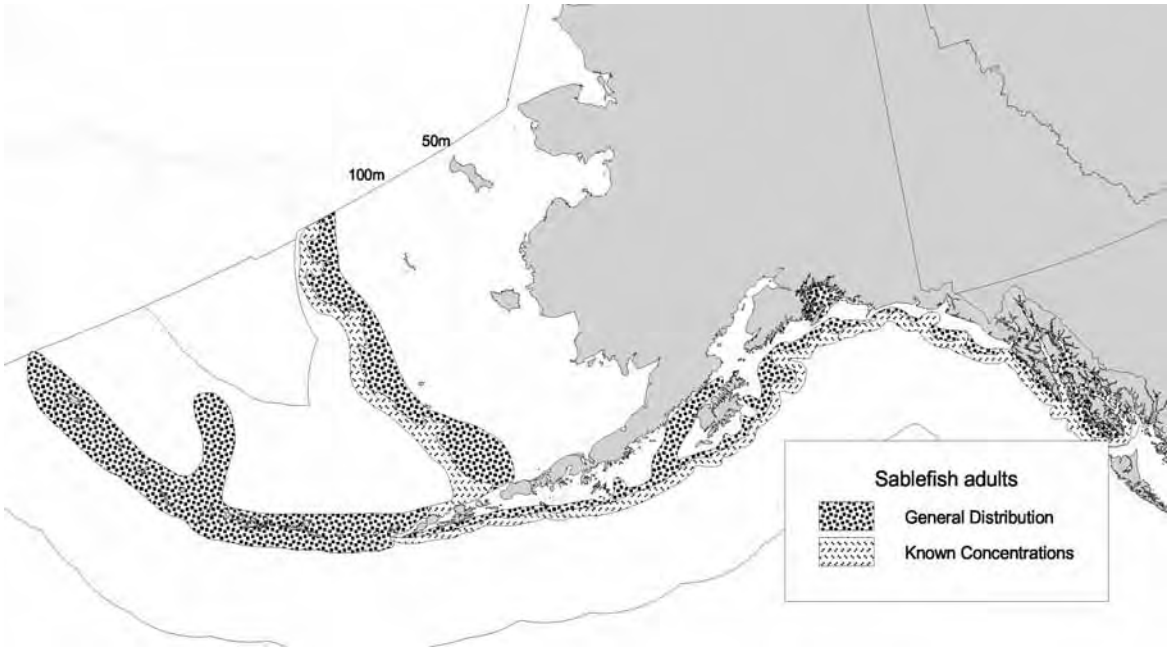

100m
200m
Walleye pollock eggs
General Distribution

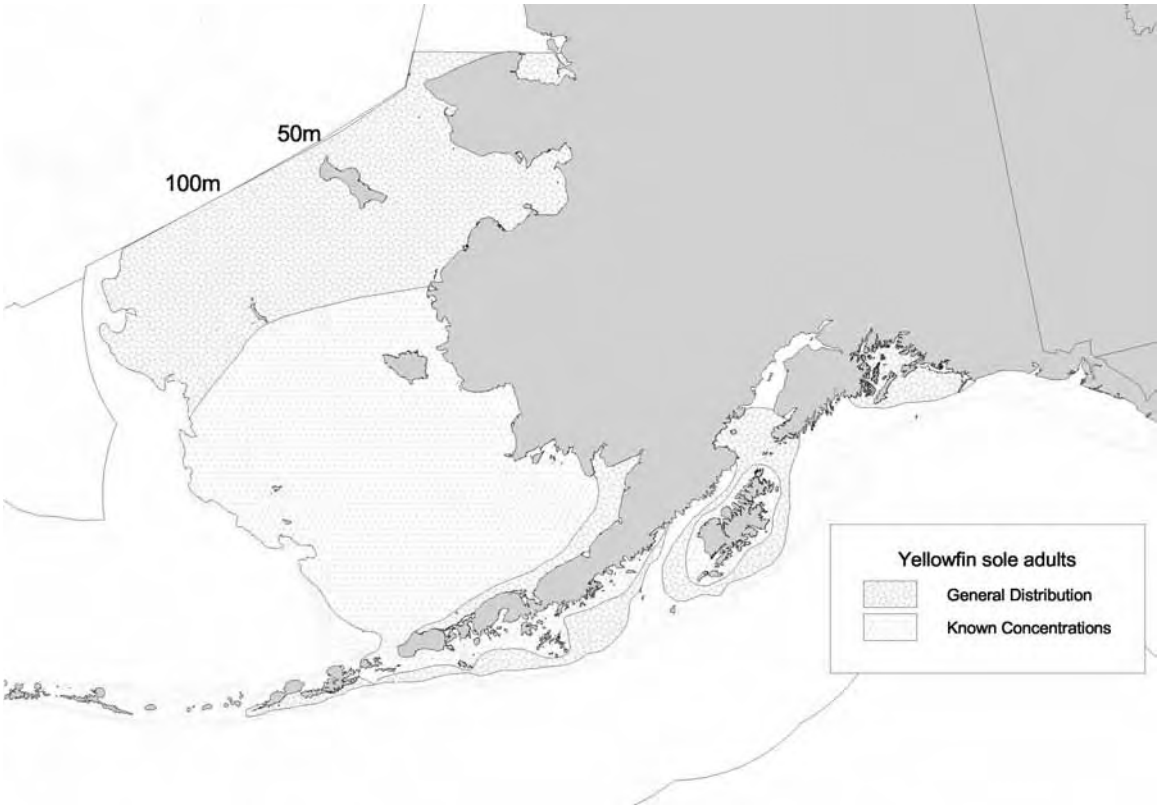

100m
200m
Walleye pollock larvae
General Distribution

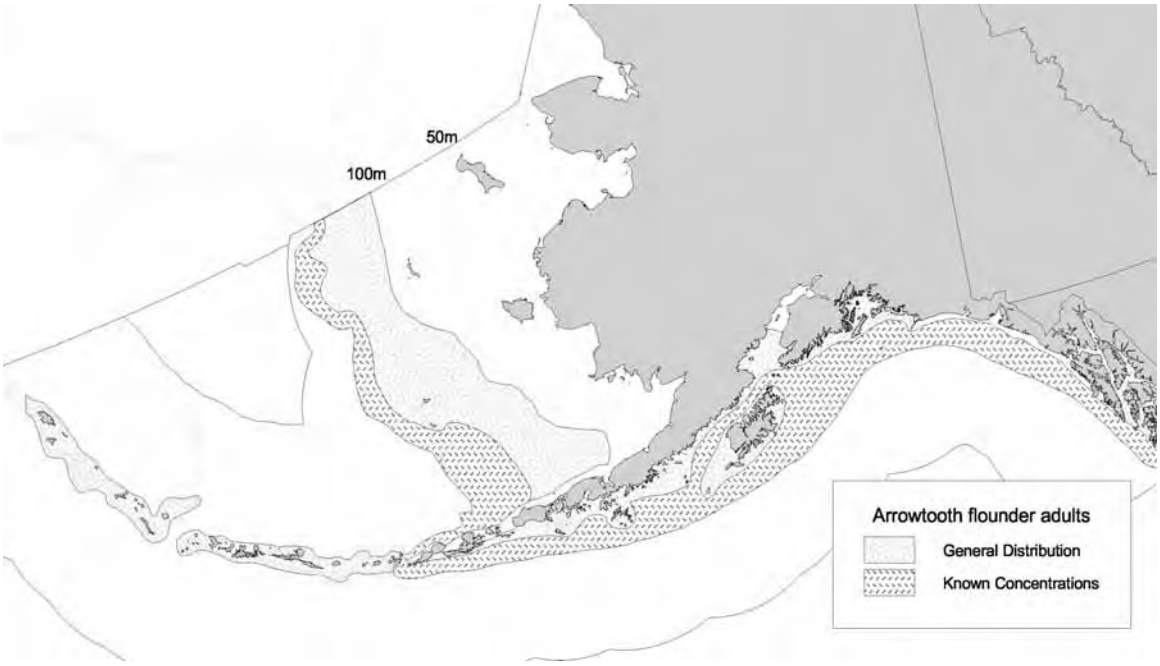

100m
200m
Walleye pollock juvenille
General Distribution

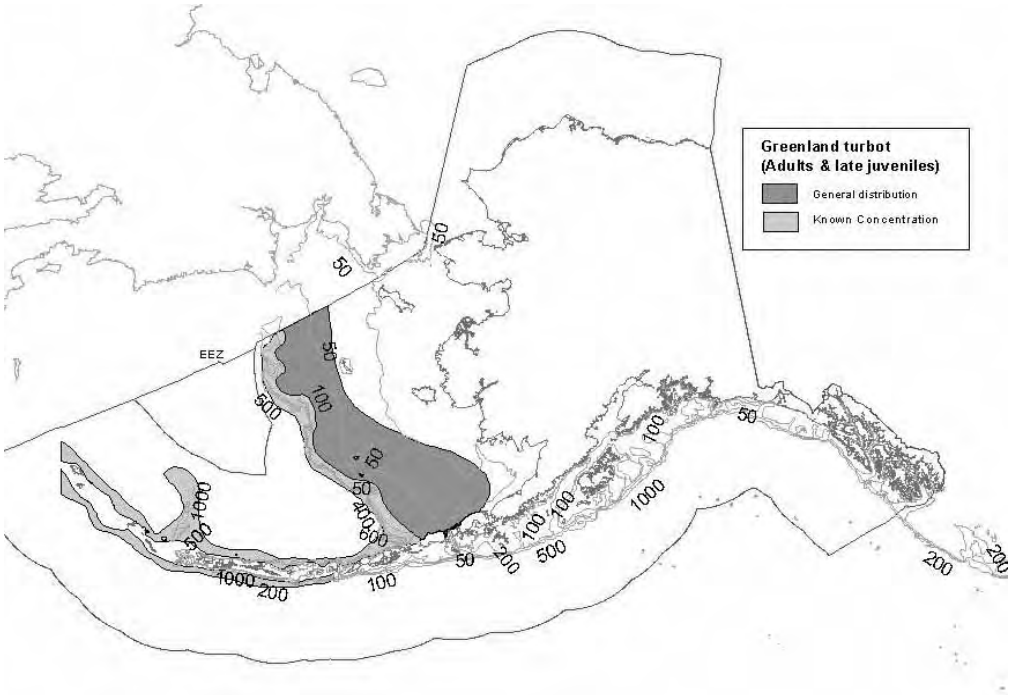

100m
200m
Walleye pollock adults
General Distribution
Known Concentrations

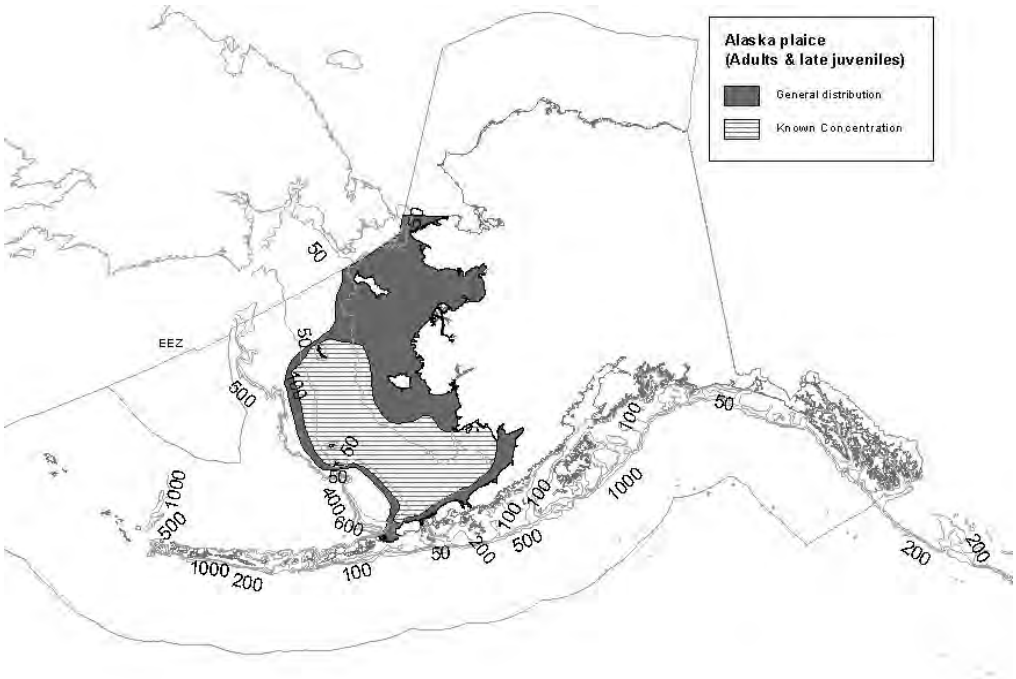

50m
100m
200m
Pacific cod adults
General Distribution
Known Concentrations

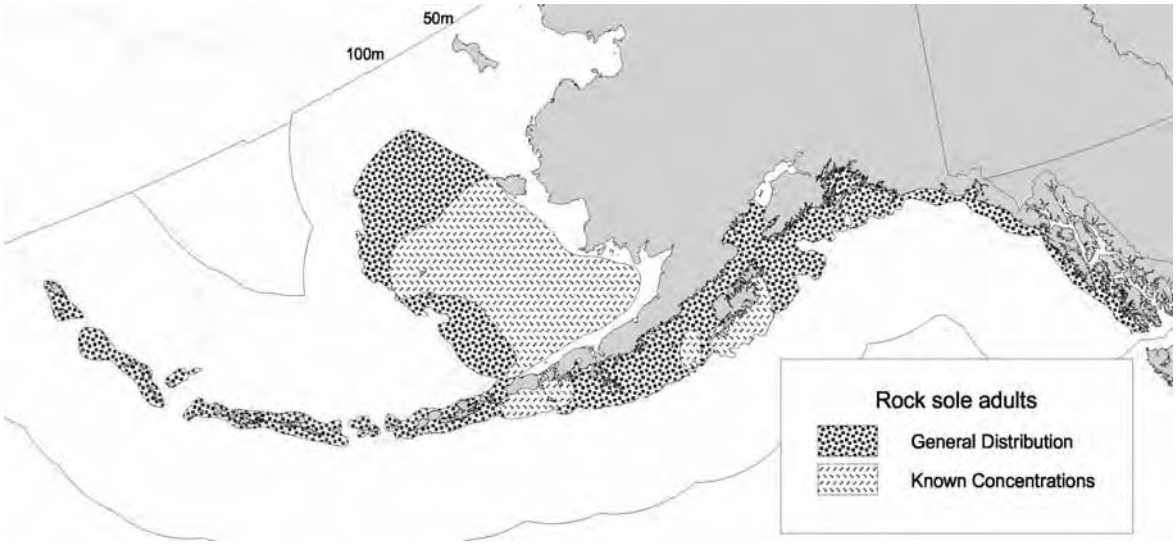

50m
100m
Sablefish adults
General Distribution
Known Concentrations

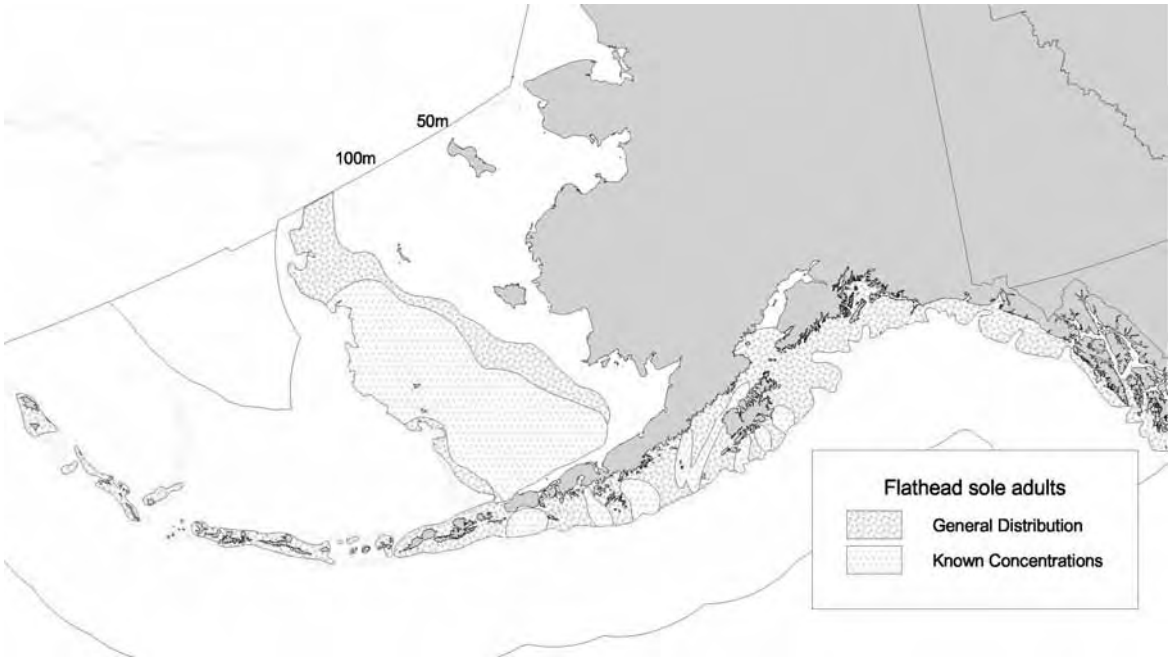

50m
100m
Yellowfin sole adults
General Distribution
Known Concentrations

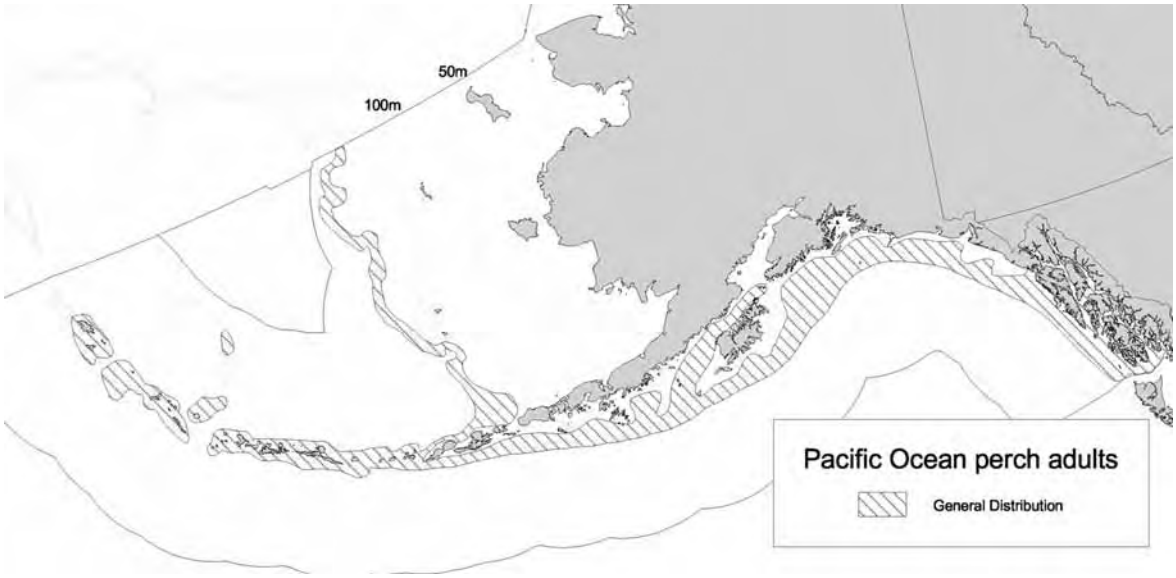

50m
100m
Arrowtooth flounder adults
General Distribution
Known Concentrations

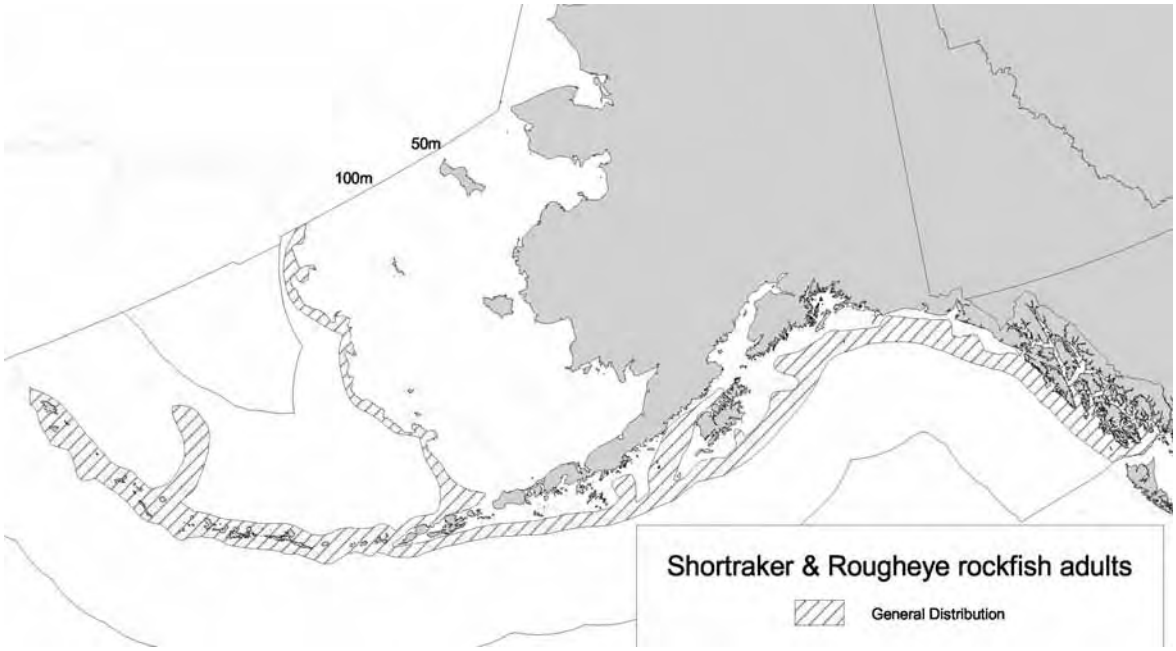

Greenland turbot
(Adults & late juveniles)
General distribution
Known Concentration
EEZ

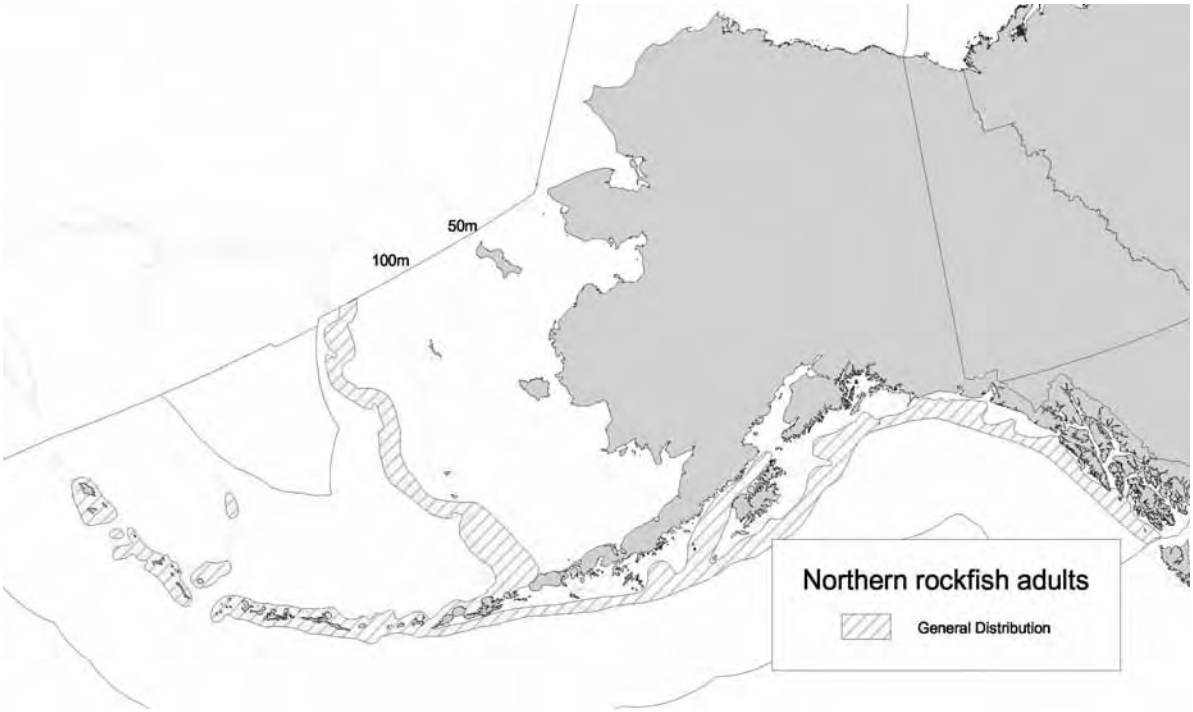

Alaska plaice
(Adults & late juveniles)
General distribution
Known Concentration
EEZ

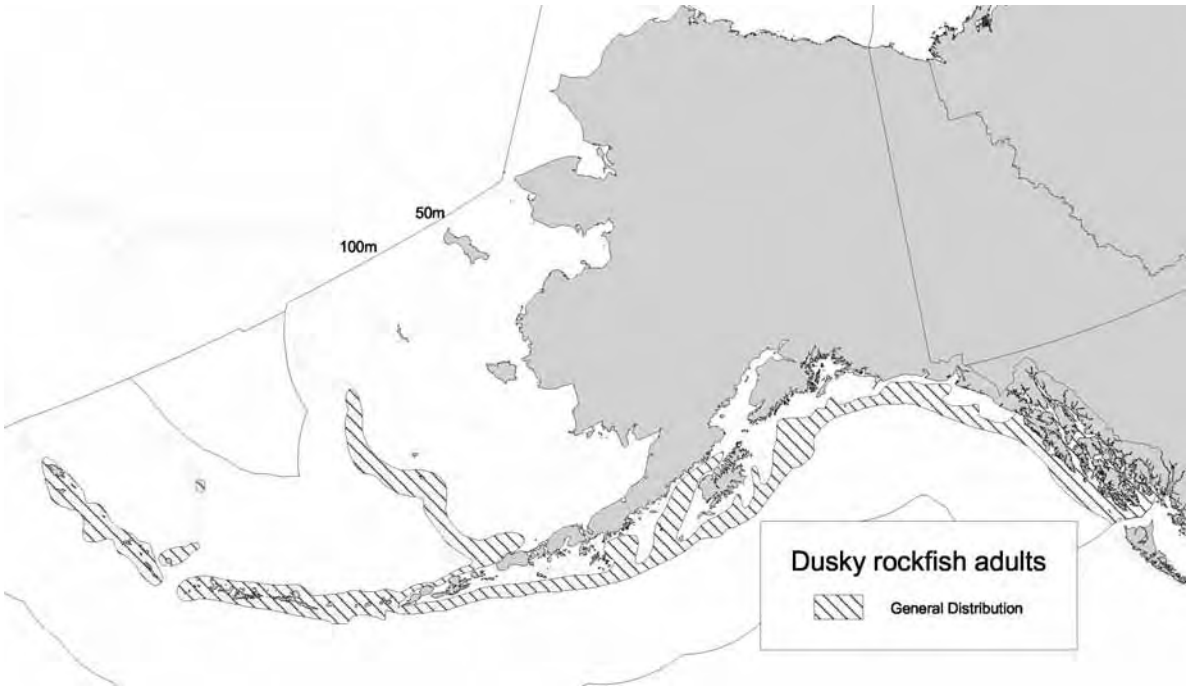

50m
100m
Rock sole adults
General Distribution
Known Concentrations

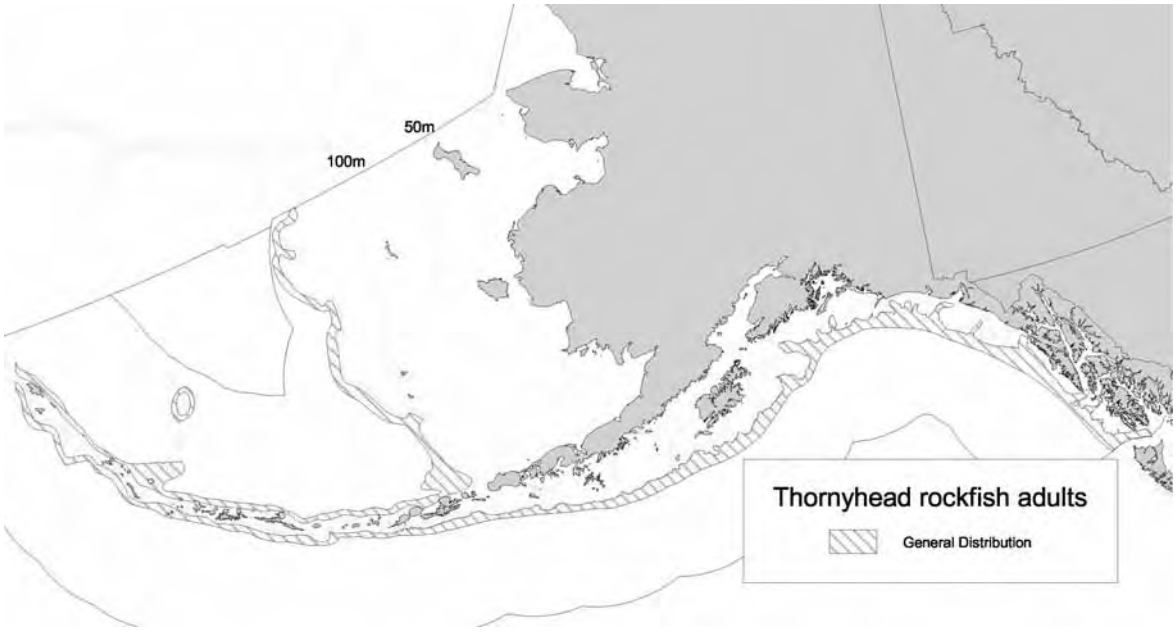

50m
100m
Flathead sole adults
General Distribution
Known Concentrations

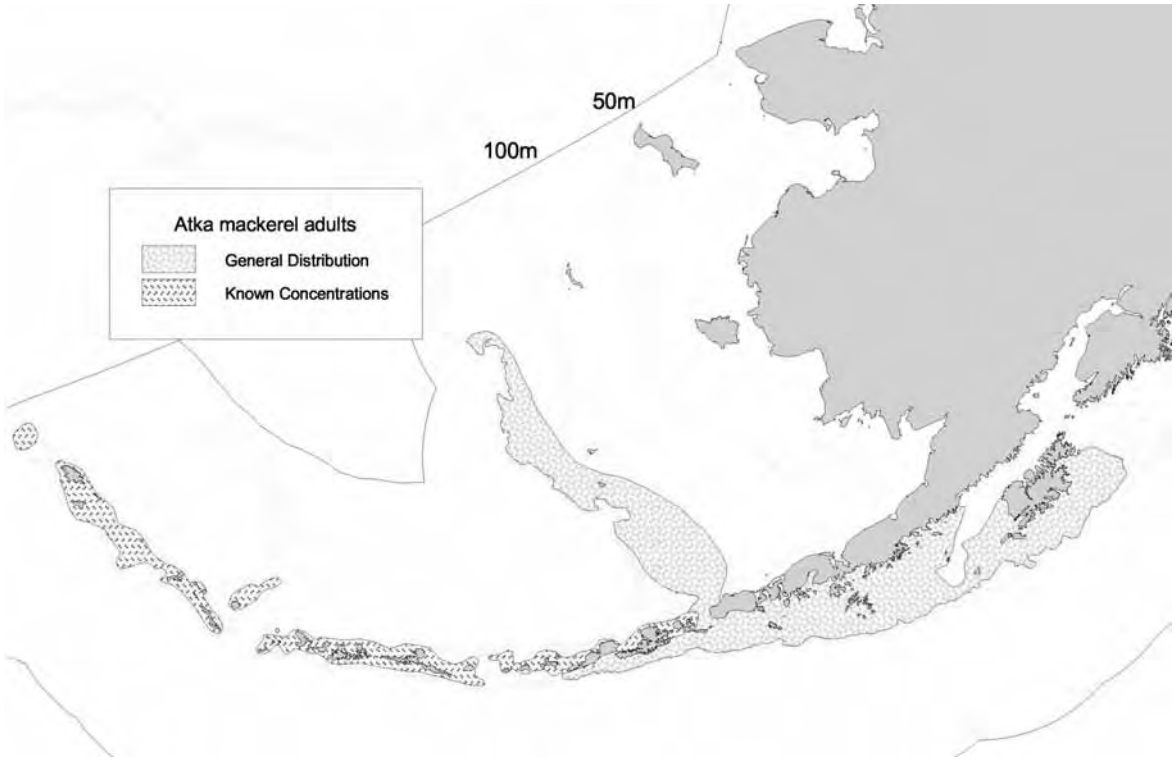

50m
100m
Pacific Ocean perch adults
General Distribution

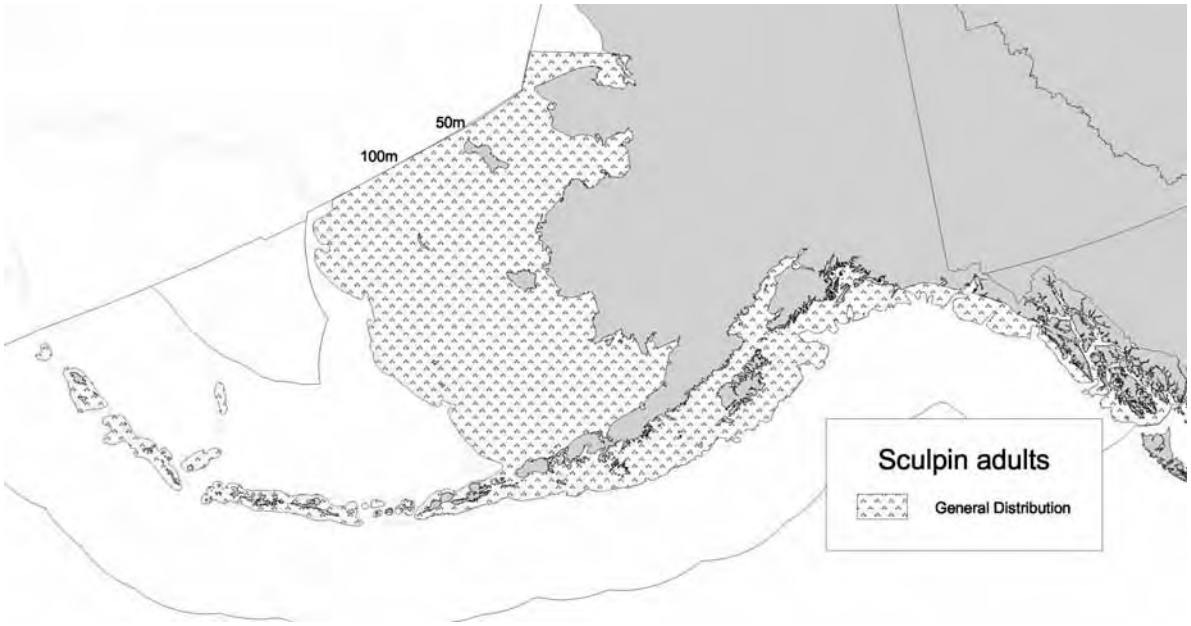

50m
100m
Shortraker & Rougheye rockfish adults
General Distribution

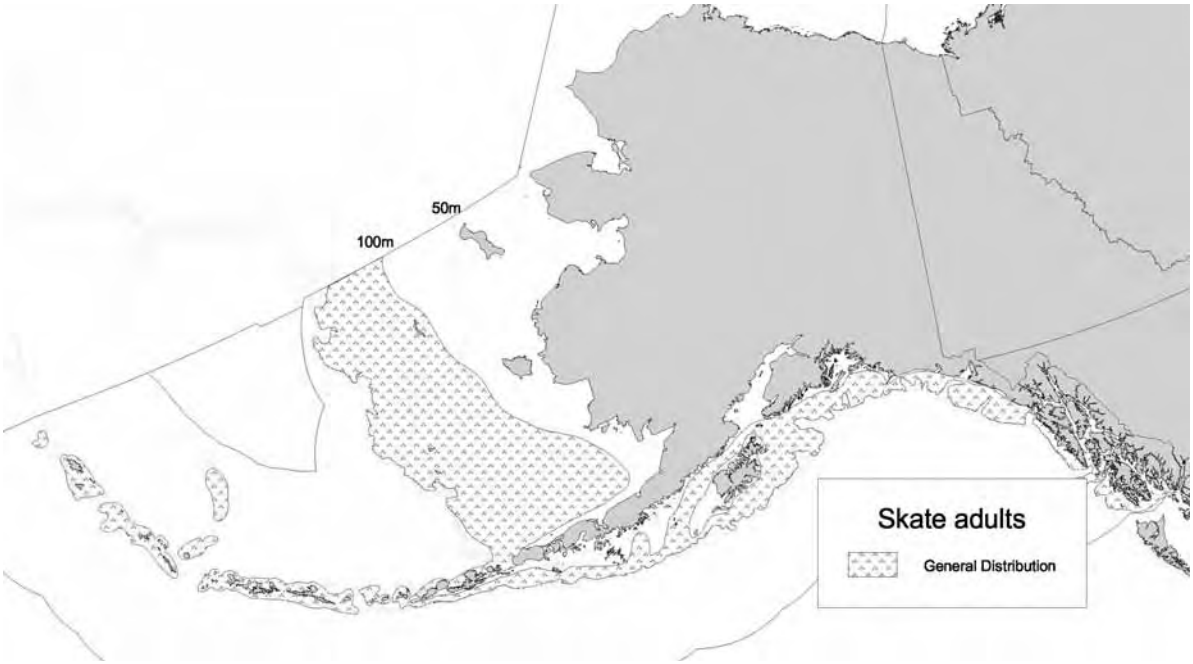

50m
100m
Northern rockfish adults
General Distribution


50m
100m
Dusky rockfish adults
General Distribution


50m
100m
Thornyhead rockfish adults
General Distribution


50m
100m
Atka mackerel adults
General Distribution
Known Concentrations


50m
100m
Sculpin adults
General Distribution


50m
100m
Skate adults
General Distribution

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Appendix F Adverse Effects on Essential Fish Habitat

This appendix includes a discussion of fishing (Section F.1) and non-fishing (Section F.2) activities that may adversely affect essential fish habitat (EFH) for Bering Sea and Aleutian Islands (BSAI) groundfish, as well as a discussion of the potential impact of cumulative effects on EFH (Section F.3).

F.1 Fishing Activities that may Adversely Affect Essential Fish Habitat

F.1.1 The Effects of Fishing on Fish Habitat: An Executive Summary

A paper entitled "The Effects of Fishing on Fish Habitat" was published in 1999 by Peter Auster and Richard Langton, prepared under contract from the American Fisheries Society. The paper summarizes and reviews the literature on fishing impacts as they relate to EFH. Interested persons may obtain this paper and other cited documents from the Council office.

The paper discusses the studies within four broad subject areas: effects of gear on non-landed target species, effects on structural components of habitat, effects on benthic community structure, and effects on ecosystem level processes. Although a vast majority of the scientific studies on gear impacts have focused on trawl gear, the authors have attempted to analyze the impacts of habitat disturbance, rather than focus on the impacts of each gear type on habitat. Towards that end, the authors have developed a conceptual model to assist managers with understanding how fishing gear could impact different habitats. Figure D-1 illustrates this. In very complex habitats, such as piled boulders or cobble with epifauna (corals, bryozoans, anenemones, etc.), even relatively low levels of fishing effort can drastically alter the habitat. On more simple habitats, such as bedforms (such as sand or silt bottoms), fishing has a relatively minor effect on the habitat complexity. An abstract of the Auster and Langton paper is provided below.

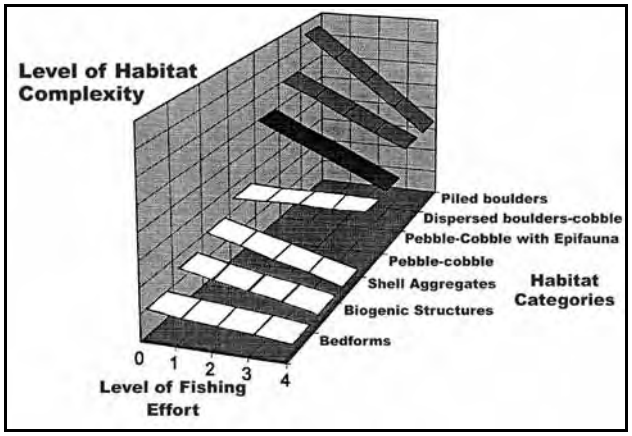

Figure F-1 Conceptual model of how fishing could differentially affect habitat depending on its complexity.

Abstract
The Sustainable Fisheries Act of 1996 mandates that regional fishery management Councils designate EFH for each of the species which are managed, assess the effects of fishing on EFH, and develop conservation measures for EFH where needed. This synthesis of effects of fishing on fish habitat was produced to aid the fishery management councils in assessing the impacts of fishing activities. A wide range of studies were reviewed that reported effects of fishing on habitat (i.e., structural habitat components, community structure,

and ecosystem processes) for a diversity of habitats and fishing gear types. Commonalities of all studies included immediate effects on species composition and diversity and a reduction in habitat complexity. Studies of acute effects were found to be a good predictor of chronic effects. Recovery after fishing was more variable, depending on habitat type, life history strategy of component species, and the natural disturbance regime. The ultimate goal of gear impact studies should not be to retrospectively analyze environmental impacts but ultimately to develop the ability to predict outcomes of particular management regimes. Synthesizing the results of these studies into predictive numerical models is not currently possible. However, conceptual models are presented which coalesce the patterns found over the range of observations. Conceptual models can be used to predict effects of gear impacts within the framework of current ecological theory. Initially, it is useful to consider fishes' use of habitats along a gradient of habitat complexity and environmental variability. A model is presented of gear impacts on a range of seafloor types and is based on changes in the structural habitat values. Disturbance theory provides the framework for predicting effects of habitat change based on spatial patterns of disturbance. Alternative community state models, and type 1-type 2 disturbance patterns, may be used to predict the general outcome of habitat management. Primary data are lacking on the spatial extent of fishing induced disturbance, the effects of specific gear types along a gradient of fishing effort, and the linkages between habitat characteristics and the population dynamics of fishes. Adaptive and precautionary management practices will therefore be required until empirical data becomes available for validating model predictions.

F.1.2 The Effects of Fishing Gear on Benthic Communities

Portions of the following section have been excerpted from the following paper:

> *Vining, I., D. Witherell, and J. Heifetz. 1997. The effects of fishing gear on benthic communities. p.13-25. Ecosystem Considerations for 1998. North Pacific Fishery Management Council, Anchorage, Alaska.*

In recent years, there has been a growing awareness and concern about the effects of resource extraction on ecosystems. Fishery managers around the world are beginning to incorporate, or at a minimum acknowledge, the effects of fishing on marine ecosystems. The groundfish fisheries in Alaska are no exception. Concern has been expressed by scientists, conservationists, fishermen, and others about potential negative effects of fishing gear on bottom habitat, particularly with regard to habitat alteration. In this chapter, we provide a review of scientific studies done to date on the effects of fishing gear on benthic communities of the BSAI area.

Fisheries in the North Pacific are numerous and utilize different gear types. The fisheries and associated gear for the BSAI and Gulf of Alaska fisheries (GOA) are listed in Table F-1. Federal regulation 50 CFR 679.2 specifies the following authorized gear types: dive, fixed gear, hook-and-line, jig, longline, longline pot, non-pelagic trawl, pelagic trawl, pot-and-line, scallop dredge, and troll gear. In this section, we summarize potential effects only for primary gears used in the groundfish fisheries.

Table F-1 Fishing Gear used in the North Pacific, by fishery.

FMP	Fishery	Gear
BSAI and GOA	groundfish	trawl, longline, jig, pot
BSAI and GOA	halibut	longline, hook&line, troll, jig
BSAI and GOA	scallop	dredge
BSAI	crab	pot
BSAI and GOA (State managed)	salmon	gill net, seine, troll line, fish wheels, or spears
non-FMP (State)	herring	trawl, seine, gill net, pound net
non-FMP (State)	shrimp	pots, trawls
non-FMP (State)	razor clam	shovel, fork
non-FMP (State)	sea urchin	handpicking, aided by diving gear or abalone iron
non-FMP (State)	octopus	pot
non-FMP (State)	abalone	diving gear and abalone iron
non-FMP (State)	sea cucumber	handpicking, aided by diving gear

If the gear, habitat, and communities were homogeneous, studies designed to measure the effect of fishing on benthic communities would be much simpler. However, there is heterogeneity in all aspects of fishing, as well as the habitat and communities affected by fishing gear. When studying gear effect, many questions need to be answered, such as: Do all gears have similar effects? How much actual damage is being done? How long will the damage last? How will damage be measured? Does the extent and longevity of damage depend on bottom type? Does the fishing affect all organisms in the community equally? The purpose of this section is to review the completed work or the work in progress to answer some of these questions, and summarize conclusions. A summary of literature used for this paper is provided in Table F-2 found in Section F.1.4.

F.1.2.1 Trawl Gear

Concerns over the effects of trawling are not new, nor limited to the North Pacific. Trawling was an issue, as early as 1350, when it was banned in the United Kingdom to protect fry of fish (de Groot 1984). Since 1938, studies have been conducted on the east coast of Canada and United States, to evaluate possible effects of trawling on the benthic communities (Ketchen 1947; Graham 1955; Messieh et al. 1991). There has also been an extensive investigation in the North Sea by the Netherlands Institute for Sea Research evaluating the effects of beam-trawl fisheries on the bottom fauna (BEON-RAPPORT 8 1990; Bergman and Hup 1992). The effects of trawling are also being studied in New Zealand and Australia, with special attention being paid to hard-bottom trawling (Hutchings 1990; Jones 1992).

There are people who considered the negative effect of trawl gear “common sense” and “intuitive,” and have written articles pointing to likely ways the gear is having a negative effect on the environment (Apollonio 1989; McAllister 1991; Russel 1997). The scientific community, in general, also tends to accept that trawling alters the bottom habitat (Auster et al. 1996). The root of the problem and the cause of controversy lies in the definition of “negative effect” and the degree of change in the benthic habitat or communities before the change is “destructive.”

The otter trawl is the principle gear used in bottom trawl fisheries in the BSAI, and advancements in fishing gear and vessel technology have made gear more efficient. These advances mean that heavier nets are dragging over seabeds, and possibly altering the sea-floor more than was observed in earlier studies. Also, larger ships, with greater horsepower and larger, stronger nets are exploring and fishing areas not previously

available to the industry (Auster et al. 1996). A further consideration is the domestication of the groundfish industry in the BSAI since the Magnuson-Stevens Act of 1976, which changed the character of trawling in Alaska from large foreign factory vessels to a mixture of a domestic catcher-processors and numerous smaller catcher vessels.

Physical effects of trawling include plowing and scraping the sea-floor, resuspension of sediment, and lowering of habitat complexity. Plowing and scraping effects depend on towing speed, substrate type, strength of tides and currents, and gear configuration (Jones 1992). It has been found that otter doors tend to penetrate the substrate 1 cm - 30 cm; 1 cm on sand and rock substrates, and 30 cm in some mud substrates (Krost et al. 1990; Jones 1992; Brylinsky et al. 1994). Another factor which will cause variation in the depth of the troughs made by the otter doors is the size (weight) of the doors, i.e., the heavier the doors the deeper the trough (Jones 1992). These benthic troughs can last as little as a few hours or days in mud and sand sediments, over which there is strong tide or current action (Caddy 1973; Jones 1992), or they can last much longer, from between a few months to over 5 years, in seabeds with a mud or sandy-mud substrate at depths greater than 100 m, with weak or no current flow (Krost et al. 1990; Jones 1992; Brylinsky et al. 1994).

Another aspect of plowing and scraping is the alteration done by the footrope. Once again, different types of footropes will cause more or less alteration. Those footropes which are designed to roll over the sea-floor (the type generally on soft bottoms, employed in the Bering Sea), cause little physical alteration, other than smoothing the substrate and minor compression (Brylinsky et al. 1994; Kaiser and Spencer 1996). However, since a trawler may re-trawl the same area several times, these minor compressions can cause a “packing” of the substrate (Schwinghammer et al. 1996). Further compression of the substrate can occur as the net becomes full and is dragged along the bottom.

The trawling of an area can cause resuspension of both inorganic and organic sediments. Churchill (1989) found that trawling can be a significant contributor to the time-averaged suspended sediment load over heavily trawled areas, especially at depths where bottom stress due to tidal and current action is generally weak. The Bering Sea (BS) has relatively weak currents with relatively strong tidal action (currents) accounting for up to 95% of all flow as deep as 200 m, with principally gravely-sand and silty-sand seabed (NRC 1996).

The reduction in habitat complexity can be examined in two broad categories: (1) small localized changes, and (2) larger area changes. The small localized changes refer to the smoothing of patchy biogenic depressions and movement of boulders (Auster et al. 1996). The broader area changes refer to the general reductions in habitat complexity with increases in trawling activity (Auster et al. 1996; Schwinghammer et al. 1996).

Mortality can be incurred to those organisms incidentally captured (bycatch), and discarded back into the sea. The mortality rate of the bycatch depends on the species, age and size of a species, the type of gear, the time and type of shipboard handling, and the size of the haul, along with ocean and atmospheric conditions (Hill and Wassenberg 1990; Stevens 1990; Fonds 1991). It is difficult to generalize the fate of bycaught benthic organisms returned to the sea or compare results from different studies on this subject. In addition, studies have only focused on the survival of fish and crab discards.

Several studies have examined the mortality of crabs taken as bycatch in North Pacific trawl fisheries. In one study, a standard sole trawl (with roller gear) in a subarctic area (Bering Sea) caught king and Tanner crabs while fishing for sole, sorted the catch with the time on deck being between .5-1.5 hours, then placed the

crabs in holding tanks for 48 hours; the resulting mortality rate was 79% for king crab and 78% for Tanner crab (Stevens, 1990). Fukuhara and Worlund (1973) observed an overall Tanner crab mortality of 60-70% in the foreign Bering Sea trawl fisheries. They also noted that mortality was higher in the summer (95%) than in the spring (50%). Natural Resource Consultants (1988) reported that overall survival of red king crab and Tanner crab bycaught and held in circulation tanks for 24-48 hours was <22%. In analyses of groundfish plan amendments, the estimated mortality rate of trawl bycaught red king crab and Tanner crab was assumed to be 80% (NPFMC 1993).

Damage or mortality of benthic organisms can occur due to the passage of the trawl over the seabed without actually catching the organisms. Non-retained organisms may be subject to mortality from contact with trawl doors, bridles, footrope, or trawl mesh, as well as exposure to silt clouds produced by trawl gear. Mortality of fish escaping from trawl codends may range from none to 100%, and may depend on numerous factors, including fish species, tow size and duration, the size and type of mesh used (Sangster 1992). Mortality can occur due to contusions, a build-up of lactic acid, scale loss and mucus removal, and skin damage due to abrasion and collision with net walls (Sangster 1992; Chopin and Arimoto 1995).

Studies of fish escapement mortality have exhibited a wide range of results. Very low escapement mortality was observed for Alaskan pollock under experimental conditions (Efanov and Istomin 1988). Main and Sangster (1988) observed that mortality of haddock passing through a diamond mesh codend exhibited delayed mortality: 33% mortality after 11 days and 82% mortality after 108 days. DeAlteris and Reifsteck (1993) observed escapement mortality of scup (Stenotomus chrysops) to be 0% to 50%, and less than 4% for winter flounder (Plueronectes americanus) tested by an experimental codend. Bergman et al. (1989) studied the mortality of fishes escaping from commercial beam trawls, and observed mortalities of dab (Limanda limanda), plaice, and sole totaled 44%, 15%, and 0%, respectively, after being held in a cage for 24 hours. Van Beek et al. (1989) also studied the mortality of sole escaping from beam trawls, and their results indicated that 40% of the sole died after escaping through the meshes. Mortality of herring (Clupea harengus) escaping from trawl codends can be higher than for groundfish. Suuronen et al. (1992) observed mortality of codend escapees to be very high (85-90%), with most deaths occurring 3-8 days after escape. Another study of herring showed lower mortality (3-30%) for herring escaping from codends (Efanov 1981).

Besides direct mortality from being caught and handled, there will be further mortality due to relocation into unsuitable habitat and predation while returning to the sea floor. This type of mortality will also depend on many conditions such as depth, type of species, age and size of species, predator concentration and oceanic conditions. Although there are few studies which have considered these sources of mortality, neither relocation nor predation will likely result in 100% mortality (Hill and Wassenberg, 1990).

Similar to the mortality of bycatch, the survival of benthic organisms in the path of the trawl will depend on several factors. The mortality rate will depend on the species, species age and size, the type of gear, the size of the haul, substrate morphology, and ocean conditions. The most severe damage done to benthic organisms by otter trawls is from the trawl doors, especially sedentary organisms that live in the upper 5 cm of the seabed (Rumohr and Krost, 1991). Rumohr and Krost (1991) further found that thin-shelled bivalves such as *Syndosmya alba*, *Mya* sp. and *Macoma calcarea*, as well as starfish sustain heavy damage due to the trawl doors, whereas thick-shelled bivalves such as *Astarte borealis* and *Corbula gibba* were less likely to be damaged. In another experiment, hard-shelled red king crab were tethered in the path of an Aleutian combination trawl (Donaldson 1990). Only 2.6% of the crabs that were interacted with the trawl, but not retained, were injured, suggesting a low mortality rate. Other organisms found to be affected by the passage of trawls and specifically the trawl doors are diatoms, nematodes and polychaetes (Brylinsky et al. 1994).

The immediate effect of trawling on hard-bottom seabeds can be intense in certain vulnerable habitats. It was found that from a single tow using roller gear, 3.9% of the octocorals and 30.4% of the stony coral were damaged, as well as 31.7% of the sponges (van Dolah et al. 1987). A similar study in Florida found that 80% of the stony coral and 38% of the soft corals were damaged, as well as 50% of the sponges. However, the trawls in this study were a ridged roller gear assemblage (Tilmant 1979). Both of these studies were in sub-tropical areas. No studies were found assessing trawling in temperate or subarctic hard-bottom habitat, however current work on this is being carried out in the GOA (Heifetz 1997).

Although mortality from bycatch or trawl passage appears to be fairly high for various organisms, some studies have found recolonization can occur over a relatively short time period. Nematodes and polychaetes returned to their pre-trawled levels in less than 7 weeks and diatoms increased in abundance in trawl troughs within 80 days (Brylinsky et al. 1994). Small epibenthic species that have been resuspended can recover to pre-trawl densities in 24 hours (Rumohr and Krost 1991). The sponges and most of the corals damaged in the hard-bottom studies, returned to their pre-study levels in approximately a year.

One of the principle concerns associated with trawling is the potential effects on benthic organisms that fish depend on for food. At least in the short term, prey items immediately available to fish do not appear to be reduced. Caddy (1973) found that fish and crabs were attracted to the trawl path, presumably to feed on exposed or dead benthos, within 1 hour after fishing. Other studies have also observed increases in scavenging in the wake of beam-trawls (Kaiser and Spencer 1994; Kaiser and Spencer 1996a). Furthermore, the densities of some of the species examined in the study, were 30 times greater than outside the trawl tracks. In Kiel Bay (Baltic Sea), it was believed that cod fed extensively on Arctica islandica which were crushed or broken by trawl doors (Rumohr and Krost 1991; Jones 1992).

Minor short-term changes in individual species distribution are not likely to greatly affect the entire ecosystem, excessively. The ecosystem is in a constant flux, with many natural phenomena making changes to the environment (de Groot 1984; Brylinsky et al. 1994). The specific question is whether fishing causes long-term changes (negative) in the benthic community structure.

There have been changes to benthic communities from trawling due to habitat alteration. The trawl doors may be the most damaging to benthic organisms on a short-term basis. However, even in deep areas where the troughs may be recognized after long periods (5 years), the doors do not likely have an excessive long-term effect on the overall area, because the relatively small trough is between 0.2 - 2 m (Krost et al. 1990; Rumohr and Krost 1991; Brylinsky et al. 1994). The greater long-term damage to the habitat may be caused by the net and footrope due to their much larger width at 3-166 m (1.5-90 fathoms), with many between 20-50 m (Grahm 1955, Chris Blackburn, Alaska Groundfish Databank, Kodiak, AK, personal communication). The smoothing caused by multiple trawls (as discussed earlier) removes patchy biogenic depressions and moves boulders, both of which are extremely important habitat to juvenile fish and crustaceans (Armstrong et al. 1993; Auster et al. 1996). Multiple trawls in an area also pack down and lower the complexity of the substrate which will likely reduce the exchange capacity and lead to less species diversity (Jones 1992; Kaiser and Spencer 1996b; Schwinghamer et al. 1996). Some studies have concluded that trawling tends to favor fast-growing, fast-reproducing and relatively short-lived (r-selected) species, such as polychaetes, at the expense of slow-growing, slow-reproducing and relatively long-lived (k-selected) species such as crustaceans (Reise 1982; de Groot 1984; Kaiser and Spencer 1996b).

Sediment resuspension, as discussed above, has an effect on the benthic communities as well. Increased sediment suspension can cause reduction of light levels on the seabed, smother benthos following

resettlement, create anaerobic conditions near the seabed, and reintroduce toxins that may have settled out of the water column (Churchill 1989; Jones 1992, Messieh et al. 1991).

F.1.2.2 Longline Gear

Very little information exists regarding the effects of longlining on benthic habitat. Observations of halibut longline gear made by NMFS scientists during submersible dives off southeast Alaska provide some information (NPFMC 1992). The following is a summary of these observations: "Setline gear often lies slack on the sea-floor and meanders considerably along the bottom. During the retrieval process, the line sweeps the bottom for considerable distances before lifting off the bottom. It snags on whatever objects are in its path, including rocks and corals. Smaller rocks are upended, hard corals are broken, and soft corals appear unaffected by the passing line. Invertebrates and other light weight objects are dislodged and pass over or under the line. Fish, notably halibut, frequently moved the groundline numerous feet along the bottom and up into the water column during escape runs disturbing objects in their path. This line motion was noted for distances of 50 feet or more on either side of the hooked fish."

Some crabs are caught incidentally by longline gear in pursuit of groundfish, and a portion of these crabs die. No field or laboratory studies have been made to estimate mortality of crab discarded in longline fisheries. However, based on condition factor information from the trawl survey, mortality of crab bycatch has been estimated and used in previous analyses (NPFMC 1993). Discard mortality rates were estimated at 37% for red king crab and 45% for *C. bairdi* Tanner crab taken in longline fisheries. No observations had been made for snow crab, but mortality rates may be similar to Tanner crab.

Mortality of groundfish discarded in longline fisheries has not been studied extensively in Alaska. Studies with Pacific halibut have shown that discards may have high mortality if not released carefully from hooks. Additionally, some species such as rockfish may not survive changes in pressure when they are hauled up quickly from the bottom. Mortality of discarded halibut has been estimated to be about 15% for most longline fisheries (Williams 1997).

F.1.2.3 Pot Gear

Pot gear is used in the North Pacific to harvest crabs and groundfish. This gear type likely affects habitat during the process of setting and retrieving pots; however, no research has been conducted to date.

Like other fisheries, pot fisheries incur some bycatch of incidental fish and crab. The groundfish pot fishery targets Pacific cod, but takes other species such as crab and flatfish which are discarded. Mortality of bycaught fish in groundfish pot fisheries has not been studied, with the exception of Pacific halibut. Based on viability data, it has been estimated that mortality of halibut bycaught in groundfish pot fisheries averages about 7% (Williams 1997).

There are a variety of effects caused by handling, ranging from sublethal (reduced growth rates, molting probabilities, visual acuity from bright lights, and vigor) to lethal effects. Several laboratory and field studies have been conducted to determine mortality caused by handling juvenile and female crab taken in crab fisheries. Studies have shown a range of mortality due to handling based on gear type, species, molting stage, number of times handled, temperature, and exposure time (Murphy and Kruse 1995). Byersdorfer and Watson (1992, 1993) examined red king crab and Tanner crab taken as bycatch during the 1991 and 1992 red king crab test fisheries. Instantaneous handling mortality of red king crab was <1% in 1991, and 11.2%

in 1992. Stevens and MacIntosh (1993) found average overall mortality of 5.2% for red king crabs and 11% for Tanner crabs on one commercial crab vessel. Authors recommend these results be viewed with caution, noting that experimental conditions were marginal. Mortality for red king crab held 48 hours was 8% (Stevens and MacIntosh 1993, as cited in Queirolo et al. 1995). A laboratory study that examined the effects of multiple handling indicated that mortality of discarded red king crabs was negligible (2%), although body damage increased with handling mortality (Zhou and Shirley 1995a).

Delayed mortality of crabs due to handling does not appear to be influenced by method of release. In an experiment done during a test fishery, red king crab thrown off the deck while the vessel was moving versus those gently placed back into the ocean showed no differences in tag return rates (Watson and Pengilly 1994). Handling methods on mortality has been shown to be non-significant in laboratory experiments with red king crab (Zhou and Shirley 1995a, 1995b) and Tanner crab (MacIntosh et al. 1995). Although handling did not cause mortality, injury rates were directly related to the number of times handled.

Mortality of crabs is also related to time out of water and air temperature. A study of red king and Tanner crabs found that crabs exposed to air exhibited reduced vigor and righting times, feeding rates (Tanner crabs), and growth (red king crabs) (Carls and O'Clair 1989). Cold air resulted in leg loss or immediate mortality for Tanner crabs, whereas red king crabs exhibited delayed mortality that occurred during molting.

F.1.2.4 Dredge Gear

Dredging for scallops may affect groundfish habitat by causing unobserved mortality to marine life and modification of the benthic community and sediments. Similar to trawling, dredging places fine sediments into suspension, buries gravel below the surface and overturns large rocks that are embedded in the substrate (NEFMC 1982, Caddy 1973). Dredging can also result in dislodgement of buried shell material, burying of gravel under re-suspended sand, and overturning of larger rocks with an appreciable roughening of the sediment surface (Caddy 1968). A study of scallop dredging in Scotland showed that dredging caused significant physical disturbance to the sediments, as indicated by furrows and dislodgement of shell fragments and small stones (Eleftheriou and Robertson 1992). The authors note, however, that these changes in bottom topography did not change sediment disposition, sediment size, organic carbon content, or chlorophyll content. Observations of the Icelandic scallop fishery off Norway indicated that dredging changed the bottom substrate from shell-sand to clay with large stones within a 3-year period (Aschan 1991). Mayer et al. (1991), investigating the effects of a New Bedford scallop dredge on sedimentology at a site in coastal Maine, found that vertical redistribution of bottom sediments had greater implications than the horizontal translocation associated with scraping and plowing the bottom. The scallop dredge tended to bury surficial metabolizable organic matter below the surface, causing a shift in sediment metabolism away from aerobic respiration that occurred at the sediment-water interface and instead toward subsurface anaerobic respiration by bacteria (Mayer et al. 1991). Dredge marks on the sea floor tend to be short-lived in areas of strong bottom currents, but may persist in low energy environments (Messieh et al. 1991).

Two studies have indicated that intensive scallop dredging may have some direct effects on the benthic community. Eleftheriou and Robertson (1992), conducted an experimental scallop dredging in a small sandy bay in Scotland to assess the effects of scallop dredging on the benthic fauna. They concluded that while dredging on sandy bottom has a limited effect on the physical environment and the smaller infauna, large numbers of the larger infauna (mollusks) and some epifaunal organisms (echinoderms and crustaceans) were killed or damaged after only a few hauls of the dredge. Long-term and cumulative effects were not examined, however. Achan (1991) examined the effects of dredging for islandic scallops on macrobenthos off Norway.

Achan found that the faunal biomass declined over a four-year period of heavy dredging. Several species, including urchins, shrimp, seastars, and polychaetes showed an increase in abundance over the time period. In summary, scallop gear, like other gear used to harvest living aquatic resources, may effect the benthic community and physical environment relative to the intensity of the fishery.

Adverse effects of scallop dredges on benthic communities in Alaska may be lower in intensity than trawl gear. Studies on effects of trawl and dredge gear have revealed that, in general, the heavier the gear in contact with the seabed, the greater the damage (Jones 1992). Scallop dredges generally weigh less than most trawl doors, and the relative width they occupy is significantly smaller. A 15' wide New Bedford style scallop dredge weighs about 1,900 lbs (Kodiak Fish Co. data). Because scallop vessels generally fish two dredges, the total weight of the gear is 3,800 lbs. Trawl gear can be significantly heavier. An 850 HP vessel pulling a trawl with a 150' sweep may require a pair of doors that weigh about 4,500 pounds. Total weight of all trawl gear, including net, footrope, and mud gear would weigh even more (T. Kandianis, personal communication). Hence, based on weight of gear alone, scallop fishing may have less effect than bottom trawling, however its effects may be more concentrated.

F.1.2.5 Salmon Fishing Gear

Directed fisheries on salmon in Alaska include marine commercial and recreational hook-and-line fisheries; marine commercial gill-net and seine fisheries; and estuarine and riverine gill-net (both set-net and drift), recreational, personal use, and subsistence fisheries. Two types of impacts can occur: (1) direct effects of the fishing gear on habitat; and (2) bycatch or entanglement of non-target species. In the marine fisheries, direct impact of the gear on marine habitats is limited, but some localized effects can occur, such as trolling weights damaging coral or purse seines damaging kelp beds or benthic structure. Bycatch and entanglement of non-target species can occur in the marine fisheries, such as bycatch of demersal rockfish in hook-and-line fisheries, and entanglement of seabirds and marine mammals in net fisheries.

F.1.2.6 Summary of the Impacts of Fishing on Habitat

Alterations to natural communities are inevitable when harvesting marine organisms with any gear type. The removal of any organism has, by itself, an effect. It has been suggested that though there is some alteration due to fishing, it is simply a necessity to harvest the resource (de Groot 1984). Furthermore, some studies have shown that the community will return to relatively pristine conditions in a relatively short time period following a fishing closure, if there was an effect at all (Graham 1955; van Dolah et al. 1987; Rumohr and Krost 1991; Jones 1992; Brylinsky et al. 1994). On the other hand, there is also the suggestion that pre-fishing, “pristine” conditions are not known, since almost all study areas have had some form of fishing prior to the study (Auster et al. 1996). Lastly, there are also studies that conclude that trawling, in some situations, may cause long-term changes in habitat and community structure (Auster et al. 1996; Kaiser and Spencer 1996b; Schwinghamer et al. 1996).

To further confuse the issue, nothing is static. The fishing industry makes regular alterations to gear and fishing techniques. The oceanic and atmospheric conditions change continually, on both local and global scales, all of which may affect groundfish or the benthic communities upon which they depend. Lastly, other human induced actions such as pollution, mining and petroleum exploration can affect benthic communities as well. However, declines of some fisheries being observed around the world have served to emphasize that all sources of potential effects should be considered by managers aiming for sustainability.

F.1.3 Loss of Prey

Loss of prey is an adverse effect on EFH because one component of EFH is that it be necessary for feeding. Therefore, actions that reduce the availability of a major prey species, either through direct harm or capture, or through adverse impacts to prey species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on a managed species and its EFH. Adverse effects on prey species and their habitats may result from fishing and non-fishing activities.

Appendix D contains tables that identify, if known, those prey species that comprise the diet of BSAI groundfish managed under the FMP. Additional information on the habitat needs of prey species that are part of the Forage Fish species category can also be found in that appendix.

F.1.4 Literature of Scientific Studies on Fishing Threats to Habitat

Table F-2 summarizes scientific studies on threats to habitat. The bibliography is found in Section F.1.4.1.

Table F-2 Summary of literature cited. Those studies done in the BSAI are shown in bold.

Authors	Year	Gear Type	Location	Fishery	Main Emphasis of Citation
Apollonio	1989	Otter Trawl	Northwest Atlantic	Groundfish	Habitat and Benthic Alterations
Armstrong, et. al.	**1993**	**Bottom Trawl**	**Bering Sea**	**Groundfish**	**Bycatch**
Auster, et.al.	1996	Otter Trawl	Gulf of Maine	Groundfish	Habitat and Benthic Alterations
BEON-Rapport 8	1990	Beam Trawl	North Sea	Groundfish	Habitat and Benthic Alterations
Bergman and Hup	1992	Beam Trawl	North Sea	Groundfish	Habitat and Benthic Alterations
Bergman, et. al.	1989	Beam Trawl	North Sea	Groundfish	Habitat and Benthic Alterations
Blackburn and Schmidt	1993	Otter Trawl	GOA (Kodiak area)	Survey	Bycatch
Brylinsky, et. al.	1994	Otter Trawl	Bay of Fundy	Flounder	Habitat and Benthic Alterations
Caddy	1973	Otter Trawl	Gulf of St. Lawrence	Groundfish	Habitat and Benthic Alterations
Churchill	1989	Otter Trawl	Mid-Atlantic Bight	Groundfish	Sediment Resuspension
de Groot	1984	Beam + Otter Trawl	North Sea	Groundfish	Habitat and Benthic Alterations
Efanov and Istomin	1988				Bycatch
Fonds, M.(ed.)	1991	Beam Trawl	North Sea		Bycatch
Fukuhara and Worlund	1973	Otter Trawl	Bering Sea	Groundfish	Bycatch
Gibbs, et. al.	1980	Otter Trawl	New South Wales	Shrimp	Habitat and Benthic Alterations
Graham	1955	Otter Trawl	North Sea	Plaice	Habitat and Benthic Alterations
Heifetz (ed.)	1997	Otter Trawl	BSAI/GOA	Groundfish	Habitat and Benthic Alterations
Hill and Wassenberg	1990	Otter Trawl	South Pacific	Shrimp	Bycatch
Hutchings	1990	Otter Trawl	Australia	Shrimp	Habitat and Benthic Alterations
Jones	1992	Beam + Otter Trawl	World Wide	Multiple	Habitat, Bycatch, Alterations
Kaiser and Spencer	1994				Bycatch
Kaiser and Spencer	1996	Beam Trawl			Bycatch
Kaiser and Spencer	1996	Beam Trawl	Europe Shelf	Groundfish	Habitat and Benthic Alterations
Ketchen	1947	Otter Trawl	Western N. Atlantic	Groundfish	Habitat and Benthic Alterations
Krost, et. al.	1990	Otter Trawl	Western Baltic	Groundfish	Habitat and Benthic Alterations
Main and Sangster	1998	Otter Trawl	North Atlantic	Groundfish	Bycatch
Mayer et.al.	1991	Otter Trawl	Gulf of Maine	Groundfish	Sediment Resuspension
McAllister	1991	Trawls (in general)	World Wide	Groundfish	Habitat and Benthic Alterations
Messieh, et.al.	1991	Otter Trawl	Eastern Canada	Groundfish	Habitat and Benthic Alterations
NRC	**1988**	**Otter Trawl**	**Bering Sea**	**Groundfish**	**Bycatch**
Owen	1988	Otter Trawl	GOA (Kodiak area)	Survey	Bycatch
Rumohr and Krost	1991	Trawls (in general)	Western Baltic	Groundfish	Habitat and Benthic Alterations
Russell	1997	Trawls (in general)	Georges Bank	Groundfish	Habitat and Benthic Alterations
Sangster	1992				Bycatch
Schwinghamer et.al.	1996	Otter Trawl	Grand Banks	Groundfish	Habitat and Benthic Alterations
Stevens	**1990**	**Otter Trawl**	**Bering Sea**	**Sole**	**Bycatch**
Suuronen et.al.	1993				Bycatch
van Beek et.al.	1989	Otter + Beam Trawls	North Sea	Flatfish	Bycatch
van Dolah et.al.	1987	Roller Trawl	Coast of Georgia	Survey	Habitat and Benthic Alterations
Williams	**1997**	**Otter Trawl**	**BSAI/GOA**	**Groundfish**	**Bycatch**

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F.2 Non-fishing related activities that may adversely affect Essential Fish Habitat

An ***Adverse Impact***, by definition, means any impact which reduces quality and/or quantity of EFH. A reduction of quality and/or quantity of EFH can be described by a direct, cumulative, and/or natural adverse impact. A ***direct impact*** to a defined EFH will result in loss of its ability to provide specific habitat for a species. ***Cumulative impacts*** are linked to the quantity and location of impacts within a given geographic area. For the purposes of this analysis, cumulative impacts are impacts on the environment that result from the incremental impact of an action when added to other past, present and reasonable foreseeable future action or threat[1], regardless of who undertakes such action. Impacts like these can build on one another, especially in developed areas or communities. Equally important are ***natural adverse impacts***, such as storm damage or climate-based environmental shifts, that can also contribute to the loss of EFH. Significant loss of EFH will reduce the species ability to reproduce, survive, or exist.

Species dependent on coastal areas during various stages of their life, particularly during juvenile rearing and adult reproduction, are more vulnerable to habitat alterations than are species that remain offshore. Also, the effects of habitat alteration on offshore species 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

[1] See attached **Non-fishing Adverse Impacts to Habitat** worksheet. The worksheet is an professional interpretative summary of broad category threats that are described in further detail throughout the Non-fishing Adverse Impacts Section.

either inshore activities or offshore uses, and (2) to the extent that some species living offshore depend directly or indirectly on coastal habitats for a critical life stage such as reproduction or as a source of food.

This section discusses types of activities that have a potential to cause habitat degradation that could affect fishery populations. This discussion is designed to identify those areas of uncertainty that may reasonably deserve attention in the future and not to be a conclusive review of impacts to EFH. Whether the likelihood and level of these activities or events cause harm to species habitats can be decided when the details of a proposed activity's location, magnitude, timing, and duration are more fully known. At present, human activities that adversely affect habitats are found near commercial fishing efforts, industrial growth areas, and community developments.

F.2.1 Dredging, Fill, Excavation

Potential impacts: excavation and maintenance of channels (includes disposal of excavated materials); construction of ports, mooring and cargo handling facilities; construction and operation of ship repair facilities; and construction of channel stabilization structures such as jetties and revetments. Impacts of disposing of dredged material are discussed in Section F.2.7.

Specific projects involving offshore marine disposals may directly impact EFH by overburdening and covering marine habitats. Because of the desirability of finding protection from Bering Sea storms, suitable port development sites often are valuable to the fishery fleet infrastructure. Recently, once such project in King Cove, Alaska, potentially could impact 20+ acres of marine habitat. This site was investigated and found not to be EFH for two species of crab, nevertheless the impact warranted investigation. Construction of a port facilities are planned for the City of Nome, Sand Point, and St. Paul, Alaska. 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 alter the physical processes of the shoreline such as currents and disruption of fish migration. Another project in the village of Unalaska, required an extension of the airport runway into water depths approximately 50-feet, and received the necessary permits for construction. 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). As human population increase, so will the desire to have new harbor developments. In Alaska, there are over 40 known Ports of Call. Many villages lack large enough harbors for trade and therefore are not a port. All these require routine dredging ranging from 1-20 year intervals.

From a broad perspective, the environmental effects of dredging can include:

- Direct removal/burial of organisms as a result of dredging and placement of dredged material;
- Turbidity/siltation effects, including increased light attenuation from turbidity;
- Contaminant release and uptake, including nutrients, metals, and organics;
- Release of oxygen consuming substances;
- Noise disturbance to aquatic and terrestrial organisms; or
- Alteration to hydrodynamic regimes and physical habitat.

Port expansion has become an almost continuous process due to economic growth, competition between ports, and significant increases in vessel size. Elimination or degradation of aquatic and upland habitats are

commonplace since port expansion almost always requires the use of open water, submerged bottoms, and riparian zones. Ancillary port related activities and development often utilize even larger areas, many of which provide water quality and other functions needed to sustain living marine resources. Vessel repair facilities utilize highly toxic cleaners, paints, and lubricants that can contaminate waters and sediments. Modern pollution containment and abatement systems and procedures can prevent or minimize toxic substance releases; however, constant and diligent pollution control efforts must be implemented.

Even with the use of approved practices and disposal sites, ocean disposal of dredged materials is expected to cause environmental harm since contaminants will continue to be released, productive bottoms will still be filled, and localized turbidity plumes and reduced oxygen zones will persist. Dredging discharge increases turbidity and sediment – this is considered by some to be the most prevalent form of pollution in Alaska waters (Lloyd et al. 1987) and has contributed to the absence of grayling in some streams (LaPerriere et al. 1985). The effects of new disposal techniques such as creation of near shore berms and such "beneficial uses" of dredged material as creation of shallow water habitats and emergent wetlands are, in many cases, unclear and resulting long-term geomorphological and ecological change could be harmful to certain species and environments.

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 resource in the area may be exposed to elevated levels of heavy metals. For example, scallop populations are vulnerable to pollution, even in offshore habitats where dumping and runoff can have an effect (Gould and Fowler 1991). Ocean dumping of sediments may bury or damage scallops by abrasion and gill clogging (Larsen and Lee 1978). Scallops are efficient at concentrating PCBs and heavy metals, including silver, copper, and nickel (Pesch et al. 1979), mercury (Klein and Goldberg 1970), cadmium (Vattutone et al. 1976), and chromium (Mearns and Young 1977). At certain levels of concentration, heavy metals can be lethal or have adverse effects at lesser concentrations. Sublethal concentrations of copper produced substantial kidney and gonad damage in sea scallops, whereas cadmium induced hormonal changes such as early gonad maturation (Gould et al. 1985).

Natural deposits of mercury are know to occur in marine bottom sediments. The levels of mercury in Norton Sound (Nelson *et al.* 1975) exceed the 3.7 ug/l set by the EPA Marine Quality Standards as the maximum allowable concentration. 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 in eastern Norton Sound will result in the discharge and resuspension of sediments that could introduce mercury to the water column.

F.2.2 Marine Mining

Potential threats include: removal of substrates that serve as habitat for fish and invertebrates; creation (or conversion) of habitats to less productive or uninhabitable sites such as anoxic holes or silt bottom; burial of productive habitats in the vicinity of the mine site or in near shore disposal sites (as in beach nourishment); release of harmful or toxic materials either in association with actual mining, or in connection with machinery and materials used for mining; creation of harmful turbidity levels; adverse modification of hydrologic conditions so as to cause erosion of desirable habitats.

Mining activity, such the extraction of gravel and gold in the Bering Sea, and placer mining spread throughout the state, can lead to the direct loss of EFH for certain species. 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 down current. During mining, water turbidity increases and the resuspension of organic materials could affect less motile organisms (i.e., eggs and recently hatched larvae) in the area. Benthic 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 the world's largest mechanical dredge was operated offshore near the city of Nome. A similar 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, juvenile fish, and adult life stages.

Mining practices that can impact EFH include physical and chemical impacts from intertidal dredging and chemicals such as flocculates. However, tailings and discharge waters from settling ponds can result in loss of EFH and life stages of managed species. Placer mining can introduce levels of heavy metals and arsenic that are naturally found within the stream bed sediments. The impact degrades the water quality and levels can become high enough to prove lethal.

The number of individual mining operations for a given area must be monitored. For instance, three mining operations in an intertidal area could impact EFH, whereas one may not. Also, disturbance of previously contaminated mining areas threaten an additional loss of EFH.

F.2.3 Fish Processing Waste - Shoreside and Vessel Operation

Potential threats include: direct and/or non-point source discharge of nutrients, chemicals, fish by-products, and stick water; overburdening of original habitats; particle suspension.

Fish waste from shoreside and vessel processing has occurred in marine waters since the 1800s. It is a direct impact to the marine environments by degrading water quality factors. Some fish waste is biodegradable such as heads, viscera, and bones. Other fish parts that are ground to fine particles and become suspended. Another byproduct of processing is fish meal waste called stick water, which is a fine gel or slime. Stick water can concentrate on surface waters and move onshore to cover intertidal areas. Seafood processing has been conducted for years in processing ports in Alaska. Crab and fish have been processed in various ports such as Kodiak, Dutch Harbor, St. Paul, and Akutan by floating and shoreside processors with little impact upon habitat for crab and other species. However, localized damage to benthic environment consisting of up to several acres of bottom being driven anoxic by rotting processing waste and piles of waste up to 26 feet deep have been recorded. Discharges from these processors now require National Pollutant Discharge Elimination System (NPDES) permits from the Environmental Protection Agency. At-sea floating processors are covered by a general NPDES permit which requires that processing waste be ground into finer than one-half inch particles and discharged below the surface (personal communication, Dr. Bruce Duncan, U.S. Environmental Protection Agency, 701 C Street, Box 19, Anchorage, AK 99513).

Although seafood has been processed at sea by foreign fishing vessels in the past without apparent harm to the marine habitat, there has been one instance reported of unusual quantities of fish carcasses (not ground in conformance with the general NPDES permit) accompanied by dead scallops brought up in scallop dredges

(Capt. Louie Audet, F/V Shayline Nicholas). It will be important to be alert to similar possible perturbations of the environment resulting from at-sea processing discharges.

Over time, suspended particles will accumulate. Juvenile and adult stages of flatfish are drawn to these areas for food sources. One effect of this attraction may lead to increased predation on juvenile fish species by other flatfishes, diving seabirds, and marine mammals drawn to the food source. However, due to the difficulty in monitoring these outfalls, impacts to species can go undetected.

Fish waste disposal at marinas can also degrade water quality where large numbers of fish are landed and cleaned, or where fish landings are limited but water circulation is poor (USEPA 1993). In sufficient quantity, fish waste disposal can cause dissolved oxygen depression, contamination, and odor problems in coastal waters (USEPA 1993).

F.2.4 Timber Harvest

Potential threats include: increase in bedload suspended sediments and turbidity from construction of logging roads, in-water stream crossings, exposed slope erosion, removal of streamside vegetation; alter streamflow; introduce excessive nutrients, decrease large woody debris; increase streambank erosion; alter temperature, and have toxic effects on biota.

Forest road construction can destabilize slopes and increase erosion and sedimentation. This erosion occurs in two forms, as mass soil movement (i.e., landslides) and as surface erosion. Both types can introduce debris and sediment into adjacent streams for many years after initial construction. Erosion is most severe where poor construction practices are allowed, inadequate attention is paid to proper road drainage, and where construction occurs in inclement weather. After construction, unpaved logging roads can be a chronic source of sediment to streams. Juvenile salmon avoid habitat areas with suspended sediment (Bisson and Bilby 1982)

Stream crossings by forest roads may block fish migration. Culverts are often installed as an economical alternative to bridges, although bridges are usually less disruptive to the stream environment. Culverts are a serious threat to salmon unless specifically designed, installed, and maintained to accommodate fish passage.

Removal of streamside vegetation during timber harvest activities increases solar radiation to the stream and results in warmer water during summer, especially in small streams. The magnitude of temperature change depends on the amount of timber harvested adjacent to the stream (Meehan et al, 1969; Brown and Krygier, 1970) and time for regrowth of riparian areas. In Southeast Alaska, Meehan et al., (1969) found that maximum temperature in logged streams exceeded those of unlogged control streams by up to 5ºC, but the temperature did not reach lethal levels. The increased water temperature, however, frequently exceeded the optimum for pink and chum salmon documented by Reiser and Bjornn (1979).

High summer air temperature has been associated with adult salmon mortality. The Alaska Department of Fish and Game compiled a list of 43 streams that had mortality of pink and chum salmon in 1977 associated with high water temperature and low flow. The largest clear-cut in Alaska is located in the Staney Creek watershed. In 1979, 15,000 pink salmon died there before spawning, a result of warm water and low oxygen. In northern areas, the removal of riparian vegetation may cause lower stream temperature during winter, increasing the formation of frazil and anchor ice.

By removing vegetation, timber harvest temporarily reduces transpiration losses from the watershed, thereby elevating water content of soil and increasing run-off during base-flow periods. The elevated water content can reduce soil strength and destabilize slopes, causing increased sediment and debris inputs to streams (Swanston 1974). Sediment deposition in streams can reduce benthic community production (Culp and Davies, 1983) and can cause mortality of incubating salmon eggs and alevins, and habitat loss for juvenile salmon (Heifetz et al. 1996). Cumulative sedimentation from logging activities can significantly reduce the egg-to-fry survival of coho and chum salmon (Cederholm et al. 1981; Cederholm and Reid 1987; Hartman et al. 1987). Where egg-to-fry survival is impaired by habitat deterioration, escapement goals may have to be increased to offset the effect of decreased spawning success.

Converting large portions of old-growth forests to rapidly growing second-growth forests can permanently reduce summer stream flows and thus permanently reduce salmonid production (Myren and Ellis, 1984). The studies of streams in second-growth forests have demonstrated that the input of large, potentially stable debris (logs and stumps) into salmon habitat from second-growth is reduced relative to inputs from old growth stands (Bisson et al. 1987). Further, the initial high productivity of prey organisms in streams running through open canopy (clear-cut) is short-lived and eventually the quantity of food organisms declines as the canopy closes (Sedell and Swanson, 1984).

F.2.5 Non-point Source Pollution and Urbanization

Potential threats: direct and/or non-point source discharge of fill, nutrients, chemicals, cooling water, air emissions, and surface and ground waters into streams, rivers, estuaries and ocean waters; conversion of wetlands to sites for residential and related purposes such as roads, bridges, parking lots, commercial facilities; elevation in inorganic and organic nutrient loading in estuarine and coastal waters; coastal development effects to adjacent and downstream ecosystems through modification of the hydrology, chemistry, and biology of streams, lakes, bays, estuaries, and the associated wetlands; and cumulative and synergistic effects caused by association of these and other developmental and non-developmental related activities.

People are moving to the coasts in increasing numbers. A major factor in the threat posed by urban and suburban development is that of non-point source (NPS) discharges of the chemicals used in day to day activities, in operating and maintaining homes and business, for maintaining roads, and for fueling vehicles. Sustainable coastal development from a fishery habitat perspective will need to combine responsible developmental practices at the local and state levels with scientific oversight of environmental conditions in the coastal zone. This can only be accomplished through long-term ecological research and education programs that allow assessment of the combined impacts of exploiting fishery stocks and habitat degradation. The results of such investigations should be used to inform the public and elected officials of the economic and social importance of healthy and productive coastal fishery habitats.

Coastal regions can experience substantial change due to rapid population growth and urbanization. Major point source and non-point source discharges have been linked to industrial/municipal facilities, abandoned hazardous waste sites, and runoff from agriculture and urbanization. Regional monitoring studies in South Carolina that measured chemical contaminants in surface waters, sediments, and biota indicated linkage between elevated levels of chemical contaminants including polycyclic aromatic hydrocarbons (PAHs) from roadways and marinas and chlordane from housing (Scott et al 1996). Similarly a correlation between elevated levels of coliform bacteria in coastal waters and urbanization was demonstrated (Scott et al 1996).

A consequence of increased human populations is an elevation in inorganic and organic nutrient loading in estuarine and coastal waters. This process can result in transient increased productivity and standing crop of phytoplankton, decreased levels of dissolved oxygen, and shifts in species composition. Higher phytoplankton production and biomass, although potentially beneficial as a food source, may cause decreases in light penetration needed for production by benthic algae, submerged aquatic vegetation and, subsequently, benthic animals. Increased nutrients also can lead to shifts in the species composition of the phytoplankton community where fewer and less desirable organisms may become prevalent. Significant depletion of dissolved oxygen has been shown to occur in association with large algal blooms and significant fish kills have been linked to this process. Nutrient loading has also been linked to noxious algal and dinoflagellate blooms that produce toxins which may be harmful to aquatic organisms and humans. Nutrient loading of scallop populations can cause low dissolved oxygen (hypoxic) conditions (Sindermann 1979), and an increase in bacterial infections (Liebovitz et al. 1984), or algal (Wassman and Ramus 1973) and dinoflagellate blooms (Shumway 1990), all of which can be detrimental to their population.

Urbanization and associated coastal development can effect adjacent and downstream ecosystems through modification of the hydrology, chemistry, and biology of streams, lakes, bays, estuaries, and the associated wetlands. Those aquatic features provide many essential ecological functions including flood and erosion control, diverse biological productivity, and as buffers to physicochemical changes in associated water bodies. Prior to the 1960s, most untreated organic and industrial wastes were dumped directly into streams, lakes or estuaries. Environmental damage from such uncontrolled waste discharge was evident from fish kills, oxygen depletion, massive blooms of nuisance algae, and public health problems. Pacific salmon were most evidently affected by pollution from raw sewage, pulp mill effluents, and acid and metal wastes. Strict regulation of point source discharges of municipal and industrial waste continue to improve that situation. Some toxins from previous unregulated discharges, however, remain trapped in bottom sediments and can be disturbed by current activities.

In urban areas, wetlands are easily degraded or lost by dredging, filling, diking, or draining to provide harbors and building sites. When wetlands are filled, their function of buffering physicochemical changes in adjacent and downstream water bodies is often lost. Development activities can, therefore, have severe impacts on anadromous fish, as well as other wetland-dependant species. Wetlands stabilize hydrology, improve water quality, and increase biological diversity in anadromous fish habitat. Wetlands store and control runoff, thereby decreasing flood peaks and erosion and providing greater base flows in downstream areas. With highly variable runoff, anadromous fish habitat may be eroded during floods and left dry during periods of low runoff. Salmon may be prevented from migrating due to velocity barriers or low water. Spawning areas may be scoured during high water or dry up or freeze during low water. Rearing salmon may be flushed into poor habitat during freshets or trapped in drying areas at low flows. Wetlands can improve water quality as nutrients and pollutants are removed through biological and chemical processes.

F.2.6 Point Source Pollution

Potential threats include; overburdening of bottom habitat near the location of outfall; degradation; degradation of water quality and habitat from storm water and industrial discharges; pollution effects that may be related to changes in water flow, pH, hardness, dissolved oxygen, and other parameters that affect individuals, populations, and communities; atmospheric pollution dispersal and mixing.

Point source discharges from municipal sewage treatment facilities or storm water discharges are controlled through U.S. Environmental Protection Agency mandated regulations under the Clean Water Act and by state

water quality regulations. The primary concerns associated with municipal point source discharges involve treatment levels needed to attain acceptable nutrient inputs and overloading of treatment systems due to rapid development of the coastal zone. Small quantities of industrial and household pollutants have the potential to become large impacts. Storm drains are contaminated from communities with settling and storage ponds, street runoff, harbor activities, and honey buckets. Sewage outfall lines also can significantly alter pH levels of saline waters.

Industrial wastewater effluent is regulated by the U.S. Environmental Protection Agency through the National Pollutant Discharge Elimination System permitting program. This program provides for issuance of waste discharge permits as a means of identifying, defining, and controlling virtually all point source discharges. The complexity and the magnitude of effort required to administer the NPDES permit program limit overview of the program and federal agencies such as NMFS and the Fish and Wildlife Service generally do not provide comments on NPDES permit notices. For these same reasons, it is not possible to presently estimate the singular, combined, and synergistic effects of industrial (and domestic) discharges on aquatic ecosystems.

At certain concentrations, point source discharges can alter the following properties of ecosystems and associated communities: diversity, nutrient and energy transfer, productivity, biomass, density, stability, connectivity, and species richness and evenness (Carins 1980). At certain concentrations, point source discharges may alter the following characteristics of finfish, shellfish, and related organisms: growth, visual acuity, swimming speed, equilibrium, feeding rate, response time to stimuli, predation rate, photosynthetic rate, spawning seasons, migration routes, and resistance to disease and parasites. In addition to direct effects on plant and animal physiology, pollution effects may be related to changes in water flow, pH, hardness, dissolved oxygen, and other parameters that affect individuals, populations, and communities (Carins 1980). Sewage, fertilizers, and de-icing chemicals (e.g., glycols, urea) are examples of common urban pollutants that decompose with high biological or chemical oxygen demand.

Contaminants that are emitted into the atmosphere by incinerators, fossil fueled power plants, automobiles, and industry may be transported various distances and directly and indirectly deposited into aquatic ecosystems (Baker *et al.* 1993). As such, the regulation of surface water contamination from atmospheric pollution may require local, regional, and international efforts. Atmospheric linkage of pollutants from local, regional, and remote sources is also possible and, accordingly, the types and levels of contaminants reaching surface waters may vary. Although the magnitude and effect of atmospheric pollution dispersal and mixing may be difficult to assess, it is clear that atmospheric contaminants are routinely deposited in coastal and estuarine waters.

F.2.7 Hazardous Material / General Litter

Potential impacts include: introduction of hazardous and toxic materials from at sea ocean disposal; disposal of contaminated dredged material; illegal dumping of trash, wastewater, and unwanted cargo; accidental disposal of material; "short dumping" of dredged material before permitted disposal area; introduction of general litter such as plastics, derelict fishing gear, and miscellaneous detrital matter.

Under provisions of the Marine Protection Research and Sanctuaries Act (MPRSA), ocean disposal of hazardous and toxic materials, other than dredged materials, is prohibited by U.S. flag vessels and by all vessels operating in the U.S. territorial sea and contiguous zone. The U.S. Environmental Protection Agency (EPA) may issue emergency permits for industrial waste dumping into ocean waters if an unacceptable

human health risk exists and no other alternative is feasible. The MPRSA assigns responsibility for the ocean disposal of dredged material to the EPA and the U.S. Army Corps of Engineers. This involves: designating ocean sites for disposal of dredged material; issuing permits for the transportation and disposal of the dredged material; regulating times, rates, and methods of disposal and the quantity and type of dredged material that may be disposed of; developing and implementing effective monitoring programs for the sites; and evaluating the effect of dredged material disposed at the sites.

Dumping of trash, wastewater, and unwanted cargo is more likely to occur on the open seas because it is less observable here than in inshore waters. Prior to passage of the Marine Plastic Pollution Research and Control Act (MPPRCA) of 1987 (PL 100-220), an estimated 14 billion pounds of garbage was being dumped into the ocean each year. Of this amount, more than 85 percent was believed to have come from the world's shipping fleet in the form of cargo associated wastes.

In the absence of MPRSA and MPPRCA repeal or weakening, major dumping threats to EFH within federal waters should theoretically be limited mostly to illegal dumping and accidental disposal of material in unapproved locations. In the present era of reduced government action and involvement, many agencies lack sufficient staff and funds to carry out mandated responsibilities, and the opportunity for unobserved illegal and accidental dumping may be substantial. This includes disposal of all types of materials as well as "short dumping" of dredged material whereby dumping takes place between the dredge site and the designated dump site.

The Act to Prevent Pollution from Ships (MARPOL ANNEX V) places limitations on ships by prohibiting discharge or deposit of any refuse matter, hazardous substance, oil, plastics and dunnage, lessening impacts to EFH. Persistent plastic debris is introduced into the marine environment from offshore vessels and commercial fisheries, as well as from general shore activities. Debris includes synthetic netting, pots, longline gear, packing bands, and rope. Estimates of debris have been based on observations of debris at sea and on beaches, and occasional reports of accidental or deliberate discards of fishing gear. Studies by Merrell (1984) and others have shown that much of the observed entanglement debris consists of fragments of trawl web. Some trawl web gets discarded overboard following net repair, but most probably gets lost during normal fishing operations (e.g., fishing over rough bottoms, foul weather). Deliberate discharge at sea of all plastics are now prohibited by MARPOL Annex V.

Debris discarded at sea can entangle or be ingested by marine mammals, fish, shellfish, sea birds, and sea turtles. The persistent nature of plastics can pose a hazard to marine life for years. Other lost or discarded gear, such as crab pots continue to fish indefinitely. Neither the extent of debris-related mortality nor population effects on various species are known.

F.2.8 Mariculture and Introduction of exotic species

Potential threats include: introduction of genetic variance into juvenile and adult populations from hatchery fish stocks; transfer and introduction of exotic and harmful organisms through ballast water discharge.

Mariculture can have adverse effects on habitat because of over-enrichment of water and benthic habitat by uneaten food, feces, or other organic materials (Faris 1987). Accumulations on the bottom can create anaerobic conditions near mariculture sites and degrade foraging areas for juvenile salmon (Phillips *et al.* 1985). Additional threats include introductions of exotic species or domestic strains which might prey upon, compete with, or interbreed with wild stocks, and the spread of disease from culture facilities. Habitat can

also be affected from the development of ancillary facilities, such as access roads, floating processing plants, or caretaker residences.

With recent introduction of the zebra mussel into the Great Lakes and its rapid dispersal into other waters considerable attention is being directed at the introduction of exotic species into U.S. waters via discharge of ship's ballast. According to one estimate (Carlton 1985) two million gallons of foreign ballast water are released every hour into U.S. waters – possibly representing the largest volume of foreign organisms released on a daily basis into north American ecosystems. The introduction of exotic organisms threatens native biodiversity and could lead to changes in relative abundances of species and individuals that are of ecological and economic importance. The social and economic implications of zebra mussel introduction into North American waters and the introduction of the comb jelly *Mnemiopsis* into the Sea of Azov in Russia – which has helped decimate the region's anchovy fishery – point out the seriousness of this threat.

F.2.9 Oil and Natural Gas Activities

Potential threats include: elimination or damage to bottom habitat due to drill holes and positioning of structures such as drilling platforms, pipelines, anchors, etc;, release of harmful and toxic substances from extracted muds, oil, and gas; and from materials used in oil and gas recovery; damage to organisms and habitats due to accidental spills; damage to fishing gear due to entanglement with structures and debris; and damage to fishery resources and habitats due to effects of blasting (used in platform support removal); and indirect and secondary impacts to near shore aquatic environments affected by product receiving, processing, and distribution facilities.

Information can be found in Berg (1977); Deis (1984); 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. Areas where oil and gas leases have occurred or are scheduled in the BSAI area include the Navarin Basin (1989)(Morris 1981), St. George Basin (1990)(NMFS 1979), North Aleutian Basin (1990)(NMFS 1980) and the Shumagin Basin (1992) (Morris 1987).

If a commercial quantity of petroleum is found, its production would require construction of facilities and all the necessary infrastructure from 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 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.

Accidental discharge of oil can occur during almost any stage of exploration, development, or production on the OCS or in near shore base areas. Oil spills may result from many possible causes including equipment

malfunction, ship collisions, pipeline breaks, human error, or severe storms. Oil spills may also be attributed to support activities associated with product recovery and transportation. In addition to crude oil spills, chemical, diesel, and other oil-product spills can occur in association with OCS activities. Of the various potential OCS-related spill sources, the great majority are associated with product transportation activities (USDOI, MMS 1996).

The 1989 *Exxon Valdez* oil spill in Prince William Sound, the largest oil spill ever in U.S. waters, contaminated 2,000 km of coastal habitat (Spies *et al.* 1996). It spilled 42 million liters of crude oil which had immediate acute effects and longer-term impacts on fish and wildlife. Beached oil penetrated deeply into cobbled beaches and still persists in some areas beneath the surface layer of rocks and under mussel beds. Contamination of intertidal spawning areas for pink salmon caused increased embryo mortality and possible long-term developmental and genetic damage (Bue *et al.* in press). Wild pink salmon spawn in intertidal stream deltas, and therefore, are susceptible to marine oil spills. The embryo is a critical stage of salmon development and is vulnerable to pollution because of its long incubation in intertidal gravel and its large lipid-rich yolk which will accumulate petroleum hydrocarbons from low-level, intermittent exposures (Heintz et al., unpub.).

Residual oil from a spill can remain toxic for long periods because the most toxic components are the most persistent. Petroleum is a complex mixture of alkanes and aromatic hydrocarbons, of which the alkyl-substituted and multi-ring polynuclear aromatic hydrocarbons (PAH) are the most toxic and persistent. These large PAH predominate in weathered oil. Because of low solubility in water, the large PAH probably contribute little to acute toxicity of oil-water solutions. Lipophilic PAH, however, may cause physiological injury if they accumulate in tissues after lengthy exposure (Heintz *et al.* unpub.).

Chronic small oil spills are also a potential problem because residual oil can build up in sediments and affect living marine resources. Low levels of PAH from such chronic pollution can be accumulated in salmon tissues and cause lethal and sublethal effects, particularly at the embryo stage. Demonstrated effects from low-level chronic exposure include increased embryo mortality, reduced marine growth, and increased straying in returning adults.

Many factors determine the degree of damage from an oil spill. The most important variables are the type of oil, size and duration of the spill, geographic location, season, and oceanographic conditions. Habitats most sensitive to oil pollution are typically located in coastal areas with low physical energy (e.g., estuaries, tidal marshes). Exposed rocky shores and ocean surface waters are high-energy environments where physical processes more rapidly remove spilled oil. Benthic and scallop species can also be affected by oil spills, via decreased gill respiration, but the effects are considered to be sort lived (Gould and Fowler 1991). Spiny scallops were found to be moderately sensitive to acute exposures (96 hour) to Cook Inlet crude and No. 2 oil (Rice *et al.* 1979).

After a large spill, aromatic hydrocarbons 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. Vertical mixing and current dispersal acts 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 near shore environment. In the shallower waters, an oil spill could be mixed by wave action throughout the water column and contaminate subtidal sediment. Suspended sediment can also act to carry oil to the seabed. In the *Exxon Valdez* oil spill, 13% of spilled oil was deposited in subtidal sediments where it was available to deposit-feeding organisms (Spies *et al.* 1996).

Oil mixed into bottom sediments persists for years and becomes a long term source of low level pollution. Cold temperature slows the evaporation biodegradation processes, so toxic hydrocarbons persist longer. Oil can also be trapped by ice. Toxic aromatic fractions mixed to depth under the surface slick could cause mortalities and sublethal effects on salmon.

Tainting of salmon and other fish flesh is a potential problem in areas subject to either chronic or acute oil pollution. The *Exxon Valdez* oil spill, for example, caused the closure of fisheries for black cod, shrimp, herring, and salmon. Although sockeye salmon were not directly affected by the spill, the fishery in upper Cook Inlet was closed to forestall fouling of gear and public perception of tainting. The sockeye fishery closure caused over-escapement to some freshwater spawning and rearing lakes and subsequent poor production of fry and smolts.

Large oil spills are the most serious potential source of oil and gas development-related pollution. 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. Chronic oil spills which build up in the sediments around rigs and facilities are also a problem. In whatever quantities, lost 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 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 near shore 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. Up to 70 percent of spilled oil may be incorporated in seafloor sediments where it is available to deposit feeding organisms (crab) and their prey items.

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. 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. 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 behavior patterns. If an oil spill reaches near shore 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. Additional concern is the unknown impact of an oil related event near and/or within ice. The water column adjacent to the ice edge is stable. This stabilization (or stratification) would allow relatively quick transport of oil to the seafloor. Additionally, oil trapped in ice could impact habitat significantly after the initial event, months or years later, and even into a different region or country.

Other sources of potential habitat degradation and pollution from oil and gas activities include the disposal of drilling muds, fluids, and cuttings to the water and seabed, and dredged materials from pipeline laying or facilities construction. Naturally occurring sediments or introduced materials may 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.

Areas that are currently and historically influenced by oil and gas production operation facilities: Arctic Ocean/ North Slope, Chukchi Sea, Bering Sea/Navarin Basin, Gulf of Alaska/Yakutat Basin, Cook Inlet, and Prince William Sound.

F.2.10 Hydroelectric Projects, Dams and Impoundments

Potential impacts include: detrimental effects on salmon and their habitat; transformation of a river from its natural free-flowing state to an impoundment fundamentally alters that environment; decline or loss of original species; change in temperature regime; change in circulation and flow patterns.

Dams are a significant barrier to upstream and downstream migrations of salmon, and have probably caused the greatest loss of salmon habitat due to human activities in the lower 48 states. Dependence on technology to provide passage around dams has seldom been successful. Fishway design and flow are important to attract and guide adult salmon into passage facilities. Poorly designed fishways can inhibit upstream movement of adults, causing migration delays, increased pre-spawning mortality, and reduced reproductive success in fish that eventually reach their spawning grounds (U.S. Bureau of Reclamation 1985; Hallock *et al.* 1982). Dams also present obstacles to downstream passage of juveniles, and passage through turbines or over spillways can result in migration delays, increase predation, and direct mortality.

Major adverse effects on salmon stocks and habitat caused by dams have been avoided or mitigated in Alaska, as managers have learned from mistakes made in the lower 48 states. A more complete discussion of effects of dams on salmon can be found in the Habitat Appendix of the Eighth Amendment to the Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California Commencing in 1978 (PFMC 1987).

Existing Federal Energy and Regulatory Commission (FERC) hydroelectric projects within Alaska include, with project # listed in parentheses: Beaver Falls (# 01922), Black Bear Lake (#10440), Blind Slough (#00201), Blue Lake (# 02230), Bradley Lake (#08221), Burnett River Hatchery (#10773), Chignik (# 00620), Cooper Lake (#02170), Dry Spruce (# 01432), Goat Lake (# 11077), Green Lake (#02818), Humpback Creek (#08889), Jetty Lake (#03017), Ketchikan Lakes (#00420), Pelican (#10198), Power Creek (#11243), Salmon Creek (#02307), Skagway-Dewey Lakes (#01051), Solomon Gulch (# 02742), Swan Lake (#02911), Terror Lake (#02743), Tyee Lake (#03015). Recent interests for new projects include: Twin Lake and Old Harbor on Kodiak Island; Silver Lake and Power Creek in Prince William Sound.

FERC projects can have concerns regarding upstream and downstream passage; provision of adequate instream flow regimes for spawning, rearing, and migration; maintenance of water quality for anadromous fish. Each of these areas is discussed below.

Fish passage for both upstream and downstream migrating salmon, steelhead, and other anadromous fish must be provided to avoid delay, injury, and excessive stress. Required passage facilities must be installed during project construction and must be operated at all times that fish are present. In order to satisfy these objectives, it is necessary to develop a proposal for fish passage facilities. The proposal should define type, location, size, method of operation, and other pertinent facility characteristics. It should reflect state and federal fisheries agency input and design criteria.

Upstream passage facilities are generally required at any project feature which impairs natural passage conditions. At some projects this may require a fish collection system with fishway entrances correctly located and adequate attraction flows, a fish ladder, and an exit structure to return adults to the stream at an appropriate location upstream from the project. At other projects, less extensive facilities are required depending upon the degree of passage obstruction and other site-specific characteristics.

For downstream migrating juveniles, the basic need is to screen turbine intakes to prevent the fish mortalities associated with passage through the turbines by excluding fish from the intake flow. Requirements concerning screen areas and mesh sizes must be satisfied to assure acceptable operation. A bypass flow to safely carry fish from in front of the screens to an appropriate location below the project is a fundamental need. Frequently a system of ports and bypass pipes is necessary. Passage facilities must be designed and maintained to function properly through the full range of flows normally occurring during fish migration periods.

Construction impacts include: siltation of spawning gravels; timing; temperature elevation or reduction which may cause reduced fish growth or disease; gas super-saturation which may occur due to plunging water and result in fish gas-bubble disease; reservoirs which tend to be nutrient traps may cause decreased fish production downstream by reducing available food supplies; silt-laden reservoir releases which decrease invertebrate production and salmon egg survival.

Construction and operation of the project without fishery considerations could result in an interruption/diversion of water supply to and degradation of water quality. The interruption/diversion could be in terms of destruction of incubating eggs, alevins, and fry in the system. Disrupted flows and/or water quality could also result in alteration of migration and spawning habitat. Construction of the dam, powerhouse, and penstock structures could increase turbidities downstream with potential impacts to migration, spawning and rearing of salmon. Construction of the dam, powerhouse, and penstock structures could also result in erosion and increased input of particulate matter into the creek with adverse impacts to migration, spawning, incubation, and rearing salmon.

Adequate flow regimes and water quality are critical for anadromous fish. Consequently, flow regimes and water quality sufficient for successful spawning, incubation, rearing, and migration must be established and maintained through and downstream of project area where needed. If flow reduction, diversion, or modification of flow regimes are anticipated in the operation scenario for the project, anadromous fisheries could be adversely affected not only in the immediate project area but in the entire system downstream of the facility. Examples of this include the diversion of water from the creek/river to a powerhouse which results in a decrease of water which reaches downstream spawning gravel and rearing habitat and tailrace

water discharges that could attract and divert returning adult fish from creek/river, thereby decreasing egg deposition and jeopardizing future returns. To address these matters, flow studies must be performed to determine flow regimes that will conserve and protect stocks of anadromous fish in the river system.

F.2.11 Marine Traffic and Transportation

Potential threats include: potentially harmful vessel operations activities include, but are not limited to: discharge or spillage of fuel, oil, grease, paints, solvents, trash, wastes (including sanitary discharges), and cargo into coastal and tributary waters; alteration of aquatic habitats by the operation of marinas, piers, and docks; disturbance and damage to living marine resources and their habitats by waves, noise, propellers, water jets and other vessel related operations such as anchoring and grounding; exacerbation of shoreline erosion due to wakes.

Routine vessel traffic, discharges, and accidents are potential threats to EFH. The Far East Trade Route takes vessels north by northwest out of the Straits of Juan De Fuca, across the North Pacific and Gulf of Alaska, then through Unimak Pass, Alaska en route to the Far East. Cargo, bunker sea, tanker, freighter, fishing, and recreational vessels make up the vast fleet that transit these waters. In recent times, the freighter vessel Swallow, tanker vessel Exxon Valdez, and freighter vessel Kiroshima grounded and the resulting oil spills proved lethal to marine life and ecosystems. Oil tug and barge traffic is common and their route transits to the major fueling ports of Unalaska, St. Paul, and other coastal cities. In addition, summer vessel traffic increases in the offshore waters with tug and tow traffic bound for the North Slope developments. Other increased traffic seasons coincide with commercial fishery openings, which usually end with at least one vessel grounding or sinking. EFH loss from hazardous cargo is ever present. Other direct impacts from vessels include pollutants such as raw sewage, bilge oil discharge, plastics, and food wastes.

The chronic effects of vessel grounding, prop scarring, and anchor damage are generally more problematic in conjunction with recreational vessels. While grounding of ships and barges is less frequent, individual incidents can have significant localized effects.

Marinas and other sites where vessels are moored are often plagued by accumulation of anti-fouling paints in bottom sediments, by fuel spillage, and overboard disposal of trash and wastewater. A study of marinas found that they may contribute to increases in fecal coliforms, sediment oxygen demand, and chlorophyll a, and decreases in dissolved oxygen.(NC Department of Environment, Health, and Natural Resources 1990)

In the Coastal Zone Management Act of 1972, as amended, Congress declared it to be national policy that state coastal management programs provide for public access to the coasts for recreational purposes. Clearly, boating and adjunct activities (e.g., marinas) are an important means of public access. When these facilities are poorly planned or managed, however, they may pose a threat to the health of aquatic systems and may pose other environmental hazards (USEPA 1993). Since marinas are located at the water's edge, there is often no buffering of the release of pollutants to waterways. The USEPA (1993) identifies the following adverse environmental impacts as possibly being related to marinas and associated activities:

1. pollutants discharged from boats;
2. pollutants generated from boat maintenance activities on land and in the water;
3. exacerbation of existing poor water quality conditions;
4. pollutants transported in storm water runoff from parking lots, roofs, and other impervious surfaces; and

5. the physical alteration or destruction of wetlands and of shellfish and other bottom communities during the construction of marinas, ramps, and related facilities.

Marina related impacts to aquatic systems include lowered dissolved oxygen, increased temperature, bioaccumulation of pollutants by organisms, water contamination, sediment contamination, resuspension of sediments, loss of subaquatic and estuarine vegetation, change in photosynthesis activity, change in the nature and type of sediment, loss of benthic organisms, eutrophication, change in circulation patterns, shoaling and shoreline erosion. Pollutants that result from marinas include nutrients, metals, petroleum hydrocarbons, pathogens, and polychlorinated biphenyls (USEPA 1993).

Marina personnel and boat owners use a variety of boat cleaners, such as teak cleaners, fiberglass polish, and detergents and cleaning boats over the water, or on adjacent upland, creates a high probability that some cleaners and other chemicals will entering the water (USEPA 1993). Copper-based antifouling paint is released into marina waters when boat bottoms are cleaned in the water (USEPA 1993). Tributyl-tin, which was a major environmental concern, has been largely banned except for use on military vessels. Fuel and oil are often released into waters during fueling operations and through bilge pumping. Oil and grease are commonly found in bilge water, especially in vessels with inboard engines, and these products may be discharged during vessel pump out (USEPA 1993).

Boats propellers can also impact fish and fish habitat by direct damage to multiple life stages of associated organisms, including egg, larvae, juveniles, and through water column de-stratification (temperature and density), resuspending sediments, and increasing turbidity (Stolpe 1997; Goldsborough 1997).

Grounding tends to be an infrequent occurrence on fishery habitats such as seagrass beds and coral reefs. The degree of damage is related to the size of the grounded vessel. Large vessels that ground in shallow water seagrass beds may cause considerable localized damage especially when propeller force is used to break free. Crushing damage is usually minimal. Grounding on coral reefs may cause extensive damage to the reef structure because most coral is highly susceptible to breakage and crushing, and recovery is slow.

One of the most conspicuous byproducts of boating activity and human occupation of coastal environments is the presence of marine debris or trash in the coastal waters, beaches, intertidal flats, and vegetated wetlands. The debris ranges in size from microscopic plastic particles (Carpenter *et al.* 1972), to mile-long pieces of drift net, discarded plastic bottles, bags, aluminum cans, etc.

Sewage and other wastes discharged from recreational boats may be most problematic in marinas and anchorage sites where vessels are concentrated. Despite existing federal and state regulations involving discharges of sewage and other materials, detection and control of related activities is difficult and some discharges still occur. According to the 1989 American Red Cross Boating Survey, there were approximately 19 million recreational boats in the United States (USEPA 1993). About 95 percent of these boats were less than 26 feet in length and a large number of these boats used a portable toilet, rather than a larger holding tank. Given the large percentage of smaller boats, facilities for the dumping of portable toilet waste should be provided at marinas that service significant numbers of boats under 26 feet in length (USEPA 1993).

Increased recreational boating activity may contribute significantly to pollution of coastal waters by petroleum products. All two-cycle outboard engines require that oil be mixed with gasoline, either directly in the tank or by injection. That portion of the oil that does not burn is then ejected, along with other exhaust products, into the water.

F.2.12 Natural Adverse Impacts

Potential threats include: geophysical and seismic activity such as volcanoes, earthquakes, shelf vents; natural occurring elements such as oil seeps and coal outcrops; coastal and inland storms that can cause severe acute and chronic perturbations including habitat erosion, burial by deposition of sediment on deepwater habitats and wetlands; creation of strong currents that alter habitats and remove biota; damage by wind and waves; elevation of turbidity that can cause physiological damage and disrupt feeding, spawning migration, and other vital processes; and abrupt changes in salinity and other water quality characteristics such as fecal coliform levels. Changes in marine habitat may also be the result of the activities of marine animals.

Long-term climatological changes can bring about similar changes by altering weather patterns. Large scale ecological changes may also occur where temperature changes favor or harm a particular species or group. Changes that cause relocation of frontal boundaries, weed lines, and stratification and temperature boundaries may also cause substantial and undesirable environmental change These events potentially can eliminate EFH for any species without any indication or warning. Impacts range from alteration of habitat from undersea landslides to introduction of exotic prey species following a favorable current. Events as such can be theorized but hard to foresee and manage.

The activities of some marine animals also alter benthic habitat. California grey whales “till the soil” when feeding on amphipods. In the Chirikof Basin and the area south of St. Lawrence Island, gray whales created pits averaging 2.5 meters long, 1.5 meters wide, and 10 centemeters deep. Creation of these pites are estimated to suspend 172 million metric tons of sediment a year – three times the amount of suspended sediment discharged annually by the Yukon River (Nelson and Johnson 1987). Pacific walrus make furrows (averaging 47 meters long, 0.4 meters wide, and 0.1 meters deep) in the benthic habitat while searching for clams and are estimated to disturb around 100 million metric tons of sediment per year (Nelson and Johnson 1987; Sease and Chapman 1988). Sea otters, by preying on sea urchins, allow kelp beds to increase which slows water movement and increases siltation rates, reducing habitat for barnacles, mussels, sea stars and hermit crabs (Palmisano and Estes 1977). Sun stars *(Pycuopodia helianthoides*) using their suckers like conveyor belts are able to dig holes up to 12 inches deep in their search for clams (Mauzen *et al.* 1968).

Although the issue of global warming is controversial, all models predict some temperature increases, especially in the higher latitudes of the Northern Hemisphere (USDC 1997). According to the U.S. Department of Commerce, significant Arctic warming, particularly after 1920, may be related to increased solar radiation, increased volcanic activity, and other naturally occurring factors (USDC 1997). Human induced increases in greenhouse gas concentrations combined with natural conditions to cause unprecedented warming in the Arctic in the 20th century and between 1840 and the mid-20th century the Arctic warmed to the highest level in the past four centuries.

Global temperature increases of a degree or two can cause sea level rise if melting of permafrost and ice cap follow. Possible effects include: significant loss of coral reefs, salt marshes, and mangrove swamps that are unable to keep up with sea level rise; loss of species whose temperature tolerance ranges are exceeded (this could be especially problematic for corals); elevated nutrient and sediment loading due to Tundra run-off; saltwater intrusion into freshwater ecosystems such as freshwater marshes and forested wetlands; invasion of warmer water species into areas occupied by cooler habitat species; and physical changes in the Arctic Seas that could have much broader implications by altering flows, food chains, and climate (USDC 1997). The severity of impact on natural resources, including certain EFH, will be determined by natural and human

obstruction to inland habitat shifts, resilience of species and populations to withstand changes in environmental conditions, and the rate of environmental change (USDC 1997).

F.2.13 Summary

Table F-3 summarizes the non-fishing adverse impacts to essential fish habitat.

Table F-3a Summary of non-fishing adverse impacts to habitat (excavation, recreation use, fish waste processing, petroleum production, and hydrological threats).

	THREATS														
	Excavation				Recreational Uses		Fish Waste Processing			Petroleum Production			Hydrological		
	Dredging	Dredge Material Disposal	Marine Mining	Nearshore Mining	Boating	Stream Bank Over-usage	Shoreside Discarge	Vessel Discharge	Aquaculture	Production Facility	Exploration	Oil Spill	Hydroelectric Dams	Impoundments	Flood Erosion/ Control
Habitat Alteration															
Alteration of original or normal habitat	X	X	X	X		X	X			X	X	X		X	X
Loss of offshore habitat		X	X							X	X	X			
Loss of pelagic habitat					X			X							
Loss of nearshore habitat	X	X		X	X		X		X	X	X	X			X
Loss of benthic habitat	X	X	X	X	X		X	X		X	X	X			
Loss of aquatic vegetation	X	X		X	X		X		X	X	X	X		X	X
Loss of wetland value	X	X				X				X	X	X		X	X
Loss of original sediment type	X	X	X	X		X	X			X		X	X	X	X
Detrimental Matter Introduction		X	X	X	X	X	X	X	X	X		X			
Topographic Alteration															
Change in original feature or structure	X	X	X	X		X	X			X	X			X	X
Accretion/overburden of original feature	X	X	X	X		X	X			X	X			X	X
Erosion/despersal of features	X		X	X		X				X	X			X	X
Organism Alteration															
Physical damage to organism	X	X	X	X	X	X					X	X		X	X
Mortality	X	X	X	X	X	X				X	X	X	X	X	X
Spatial alteration		X							X	X					
Gene pool deterioration									X			X			
Introduction of exotic species					X				X						
Introduction of pathogens/disease		X	X	X	X	X	X	X	X	X	X	X	X	X	
Change in photosynthetic regime	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Oceanographic Alteration															
Change in temperature regime	^	^	X	^	^		X		X	X					
Change in salinity	^	^	X	^	^		X		X	X		^			
Change in circulation pattern	^	^	X	^	^				X	X	X				
Water Quality Alteration															
Change in dissolved oxygen content	^	^	^	^	^		^	^	^			X	X	X	X
Eutrophication, nutrient loading	X	X	X	X	^	X	X	X	X					X	X
Water contamination	X	X	X	X	X	X	X		X	X	X	X			
Suspended sediments, turbidity	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Atmospheric deposition					X					X	X	X			

^ - short term impact

Table F-3b Summary of non-fishing adverse impacts to habitat (agricultural, harbors/ports/ marinas, municipal and industrial, environmental, and marine transportation threats).

	THREATS																
	Agricultural				Harbors/Ports/ Marinas			Municipal and Industrial				Environmental			Marine Transportation		
	Agricultural/ Farming	Insect Control	Forestry	Water Diversion	Port Construction	Port Development	Artifical Reefs	Non-point Source	Coastal Urbanization	Sewage Treatment	Storm Water Runoff	Climatic Changes/ Shifts	Toxic Algal Bloom	Intro. of Exotic Species	Vessel Groundings	Ballast Water	Marine Debris
Habitat Alteration																	
Alteration of original or normal habitat	X		X	X	X	X	X		X	X					X		X
Loss of offshore habitat																	
Loss of pelagic habitat								X				X				X	X
Loss of nearshore habitat	X	X	X	X	X	X	X	X	X	X	X	X			X		X
Loss of benthic habitat					X	X	X	X	X	X					X	X	X
Loss of aquatic vegetation	X	X	X	X	X	X		X	X			X			X		X
Loss of wetland value	X	X	X	X	X	X		X	X								
Loss of original sediment type	X		X		X	X		X	X						X		X
Detrimental Matter Introduction	X		X		X	X		X	X	X	X				X		X
Topographic Alteration																	
Change in original feature or structure	X		X	X	X	X	X		X						X		
Accretion/overburden of original feature	X		X	X	X	X	X	X	X	X		X					X
Erosion/despersal of features	X		X	X	X	X	X		X			X			X		
Organism Alteration																	
Physical damage to organism		X	X		X	X		X	X	X	X		X	X	X	X	X
Mortality		X			X	X		X	X	X	X		X	X	X	X	X
Spatial alteration	X		X		X	X	X	X	X					X			X
Gene pool deterioration								X	X	X	X		X	X		X	
Introduction of exotic species									X	X	X			X	X	X	
Introduction of pathogens/disease	X	X				X		X	X	X	X		X	X	X	X	X
Change in photosynthetic regime		X	X	X	X	X	X	X	X	X	X	X	X			X	X
Oceanographic Alteration																	
Change in temperature regime	^		X	^	^		X	X	X	X	X	X				X	
Change in salinity	^		^		^		X	X	X	X	X	X	^			X	
Change in circulation pattern				X	X	^	X		X			X					
Water Quality Alteration																	
Change in dissolved oxygen content	X			X	^	^		X	X	X	X		X				
Eutrophication, nutrient loading	X			X					X	X	X			X			
Water contamination	X	X	X	X	X	X		X	X	X	X				X	X	X
Suspended sediments, turbidity	X		X	X	X	X			X		X						
Atmospheric deposition		X						X	X			X					

^ - short term impact

F.2.14 References

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F.3 Cumulative Effects from Fishing and Non-Fishing Activities

The Council and the Secretary of Commerce have taken appropriate actions when threats to fish habitat have been identified. These include cumulative effects from fishing activities and non-fishing activities. Cumulative effects have been examined in the Stock Assessment and Fishery Evaluation (SAFE) reports, which are produced annually for the BSAI groundfish fisheries, and NEPA analyses for fishery management actions. In addition, an Ecosystem Considerations section to the SAFE reports is prepared which identifies specific ecosystem concerns that are considered by fishery managers in maintaining sustainable marine ecosystems.

Cumulative effects from non-fishing activities relate to the amount of habitat loss from human interaction and alteration or natural disturbances. Non-fishing activities are widespread and can have localized impacts to groundfish habitats such as accretion of sediments from at-sea disposal areas, oil and gas exploration, sea floor mining, ice scouring and significant storm events. In addition to EFH consultation guidelines mandated by the Magnuson-Stevens Act, NMFS reviews these types of effects during the review process required by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act for certain activities that are regulated by Federal, state, tribal or local authority. The jurisdiction of these activities is in "waters of the United States" and includes both riverine and marine habitats. To assist in understanding these widespread impacts, the development of a habitat and effect baseline database would accelerate the review process and outline areas of increased disturbance. Inter-agency coordination would prove beneficial to all.

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Appendix G Fishery Impact Statement

The Magnuson-Stevens Fishery and Conservation Management Act (Magnuson-Stevens Act) requires that a fishery management plan (FMP) include a fishery impact statement that assesses, specifies, and describes the likely effects of the FMP measures on participants in the fisheries and fishing communities affected by the FMP. A detailed analysis of the effects of the FMP on the human environment, including fishery participants and fishing communities, was conducted in the *Alaska Groundfish Fisheries Programmatic Supplemental Enivonmental Impact Statement* (NMFS 2004). The following is a brief summary from this analysis.

The FMP has instituted privilege-based management programs in the some groundfish fisheries, and fishery managers, under the guidance of the FMP management policy, are moving towards extending privilege-based allocations to other groundfish fisheries.

- The FMP promotes increased social and economic benefits through the promotion of privilege-based allocations to individuals, sectors and communities. For this reason, it is likely to increase the commercial value generated from the groundfish fisheries.
- As the race-for-fish is eliminated, the FMP could result in positive effects in terms of producer net revenue, consumer benefits, and participant health and safety.
- The elimination of the race-for-fish will likely result in a decrease in overall participation levels. In the long-run, communities are likely to see fewer persons employed in jobs related to the fishing industry (fishing, processing, or support sectors), but the jobs that remain could be more stable and provide higher pay.
- The FMP's promotion of privilege-based allocations is also expected to increase consumer benefits and health and safety of participants.

The FMP has adopted a variety of management measures to promote the sustainability of the groundfish fisheries and dependent fishing communities.

- Management measures to account for uncertainty ensure the sustainability of the managed species by maintaining a spawning stock biomass for the target species with the potential to produce sustained yields.
- The transition to privilege-based management in the short-term could disrupt stability, however in the long-term, the stability of fisheries would be increased in comparison to a derby-style fishery.
- Communities would also tend to experience an increase in stability as a result of built-in community protections to the privilege-based management programs.

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Appendix H Research Needs

Although research needs are identified in this appendix to the Fishery Management Plan (FMP), ongoing research and research needs are constantly being updated. It may therefore be useful to the reader to access other sources in order to obtain the North Pacific Fishery Management Council (Council)'s most current description of research and research needs on the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries. A complete discussion of up-to-date sources is included in Chapter 6 of the FMP. In particular, the Council's Science and Statistical Committee regularly updates the Council on its research needs, and these can be found on the Council's website. Additionally, ongoing research by National Marine Fisheries Service (NMFS)' Alaska Fisheries Science Center is also accessible through their website. Website addresses are in Chapter 6.

The FMP management policy identifies several research programs that the Council would like to encourage. These are listed in Section H.1. The Council relies on its Scientific and Statistical Committee (SSC) to assist the Council in interpreting biological, sociological, and economic information. The SSC also plays an important role in providing the Council with recommendations regarding research direction and priorities based on identified data gaps and research needs. The SSC and Council's research priorities are listed in Section H.2. Additionally, NMFS regularly develops a five-year strategy for fisheries research which is described in Section H.3. Research needs specific to essential fish habitat are described in Section H.4.

H.1 Management Policy Research Programs

The management objectives of the FMP (see Section 2.2.1) include several objectives that provide overarching guidance as to research programs that the Council would like to encourage.

- Encourage research programs to evaluate current population estimates for non-target species with a view to setting appropriate bycatch limits as information becomes available.
- Encourage programs to review status of endangered or threatened marine mammal stocks and fishing interactions and develop fishery management measures as appropriate.
- Encourage development of a research program to identify regional baseline habitat information and mapping, subject to funding and staff availability.
- Encourage a coordinated, long-term ecosystem monitoring program to collect baseline information and compile existing information from a variety of ongoing research initiatives, subject to funding and staff availability.

Other objectives in the management policy also contain research elements without which they cannot be achieved. Research initiatives that would support other FMP management objectives are discussed in Section H.1.2 below.

H.2 Council Research Priorities

At its March 2003 meeting, the SSC reviewed the list of research priorities as developed by the Council's BSAI and GOA groundfish plan teams, and developed the following short list of research topics:

A. Critical Assessment Problems

For rockfish stocks there is a general need for better assessment data, particularly investigation of stock structure and biological variables.

- Supplement triennial trawl survey biomass estimates with estimates of biomass or indices of biomass obtained from alternative survey designs.
- Obtain age and length samples from the commercial fishery, especially for Pacific ocean perch, northern rockfish, and dusky rockfish.
- Increase capacity for production ageing of rockfish so that age information from surveys and the fishery can be included in stock assessments in a timely manner.
- Further research is needed on model performance in terms of bias and variability. In particular, computer simulations, sensitivity studies, and retrospective analyses are needed. As models become more complex in terms of parameters, error structure, and data sources, there is a greater need to understand how well they perform.

There is a need for life history information for groundfish stocks, e.g., growth and maturity data, especially for rockfish.

- There is a need for information about stock structure and movement of all FMP groundfish species, especially temporal and spatial distributions of spawning aggregations.

B. Stock Survey Concerns

- There is a need to explore ways for inaugurating or improving surveys to assess rockfish, including nearshore pelagics.
- There is a need to develop methods to measure fish density in habitats typically inaccessible to NMFS survey gear, i.e., untrawlable habitats.

C. Expanded Ecosystem Studies

- Research effort is required to develop methods for incorporating the influence of environmental and climate variability, and there influence on processes such as recruitment and growth into population models, especially for crab stocks.
- Forage fish are an important part of the ecosystem, yet little is known about these stocks. Effort is needed on stock status and distribution for forage fishes such as capelin, eulachon, and sand lance.
- Studies are needed to identify essential habitat for groundfish and forage fish. Mapping of nearshore and shelf habitat should be continued for FMP species.

D. Social and Economic Research

- Development of time series and cross-sectional databases on fixed and variable costs of fishing and fish processing.

- Pre- and post-implementation economic analyses of crab and GOA groundfish rationalization.
- Identification of data needed to support analyses of community level consequences of management actions.
- Development of integrated multispecies/multifishery models for use in analyses of large scale management actions, such as Programmatic SEIS and EFH.

E. Bycatch

- Identify sources of variability in actual and estimated bycatch rates.

F. Monitoring

- Promote advance in video monitoring of other wised unobserved catch for improved estimation of species composition of total catch and discrimination of retained and discarded catch

G. Research Priorities Identified by the NRC Steller Sea Lion Committee

The SSC held a brief discussion on the research and monitoring recommendations of the NRC Steller Sea Lion Committee, as presented in the Executive Summary of their report. The SSC noted that their recommendations are consistent with recognized needs, but also that there is considerable ongoing Steller sea lion research. Among the NRC's recommendations, the SSC wishes to particularly identify their recommendation for a spatially-explicit, adaptive management experiment to definitively conclude whether fishing is playing a role in the current lack of Steller sea lion recovery. As noted in the SSC's February 2003 minutes, there are a number of scientific, economic, and Endangered Species Act (ESA) regulatory considerations that must be addressed before such a plan can be seriously considered for implementation. However, the SSC supports further exploration of the merits of this adaptive management approach.

H.3 National Marine Fisheries Service

NMFS is responsible for ensuring that management decisions are based on the best available scientific information relevant to the biological, social, and economic status of the fisheries. As required by the Magnuson-Stevens Act, NMFS published the *NMFS Strategic Plan for Fisheries Research* in December 2001, outlining proposed research efforts for fiscal years 2001-2006. The Strategic Plan outlines the following broad goals and objectives for NMFS: 1) to improve scientific capability; 2) to increase science quality assurance; 3) to improve fishery research capability; 4) to improve data collection; 5) to increase outreach/information dissemination; and 6) to support international fishery science. The document also outlines the NMFS Alaska Fisheries Science Center (AFSC)'s research priorities for this time period. Summarized below are the AFSC's research priorities grouped into four major research areas: research to support fishery conservation and management; conservation engineering research; research on the fisheries themselves; and information management research.

1. Research to Support Fishery Conservation and Management

- Biological research concerning the abundance and life history parameters of fish stocks

- Conduct periodic (annual, biennial, triennial) bottom trawl, midwater trawl-acoustic, hydroacoustic bottom trawl, longline surveys on groundfish in the Bering Sea and GOA.
- Conduct field operations to study marine mammal-fish interactions, with particular emphasis on sea lion-pollock/cod/Atka mackerel interactions in the GOA and the BSAI areas.
- Observer programs for groundfish fisheries that occur off Alaska.
- Assessments of the status of stocks, including their biological production potentials (maximum sustainable yield, acceptable biological catch, overfishing levels), bycatch requirements, and other parameters required for their management.
- Assessments of the population dynamics, ecosystem interactions, and abundance of marine mammal stocks and their incidental take requirements.

b. Social and economic factors affecting abundance levels

c. Interdependence of fisheries or stocks of fish

d. Identifying, restoring, and mapping of EFH

e. Assessment of effects of fishing on EFH and development of ways to minimize adverse impacts.

2. Conservation Engineering Research

- Continue to conduct research to measure direct effects of bottom trawling on seafloor habitat according to a five-year research plan.
- Conduct fishing gear performance and fish behavioral studies to reduce bycatch and bycatch mortality of prohibited, undersized, or unmarketable species, and to understand performance of survey gear.
- Work with industry and the Council to develop bycatch reduction techniques.

3. Research on the Fisheries

a. Social and economic research

b. Seafood safety research

c. Marine aquaculture

4. Information Management Research

- Continue to build data infrastructure and resources for easy access and data processing. The AFSC's key data bases are its survey data bases from the 1950s (or earlier) and the scientific observer data base that extends back to the foreign fishing days of the 1960s.
- Continue to provide information products based on experts and technical data that support NMFS, the Council, international scientific commissions, and the overall research and management community.

H.4 Essential Fish Habitat Research and Information Needs

Alaska leads the Nation in fish habitat area and in the value of fish harvested, yet the most basic information on distribution and habitat utilization for most early life stages of commercially valuable groundfish and shellfish is lacking. Systematic sampling exists only for targeted adults. A program is required to generate distributional data on which to determine essential fish habitat (EFH) for the juvenile and larval stages of most of our marine fish. Additionally, Alaska fisheries are affected by anthropogenic impacts, including anthropogenic development that impacts watersheds, wetlands, estuaries, and nearshore benthic environment. Priority needs to be given to identifying, assessing and mapping habitat types such as offshore larval concentration areas (i.e. gyres), nearshore nursery areas such as eel grass beds, rocky outcroppings, fine/mixed sediments, and productive bottom types for juveniles and adults. Functional value of high-priority habitats need to be established, and the linkages between fishery productivity and habitats need to be understood. Fishing impact studies are in their infancy in Alaska. Increased emphasis needs to be placed on fish ecology, and marine benthic habitat typing in conjunction with impact assessments of trawls, dredges, longlines, pot gear, and other fishing gear used in Alaska fisheries. Development of a standardized marine benthic habitat typing technology is a required precursor.

Specific research needs for the BSAI are:

1. Surveys and studies of nearshore pelagic and benthic areas are needed to determine their use by a variety of species, including Atka mackerel, Pacific cod, pollock, rockfish. sablefish, octopus and flatfishes and juveniles and larvae of all species and forage species considered in the FMP.
2. Information on habitat distribution, in conjunction with fish distribution, is needed to determine species' habitat requirements and utilization. Information on the extent and distribution of complex habitat types susceptible to bottom fishing will improve the evaluation of the potential of a fishery to physically alter bottom habitat and consequent measures to minimize impacts. To attain this information, increased use of remote bottom typing technology is necessary, as well as increased application of currently available technology such as multi-beam sonar that can provide detailed topographic maps of the continental shelf and slope.
3. Research is necessary to raise the level of information known on a species life stage from Level 0 or 1 to Level 2 or higher. To increase EFH tier levels and obtain valid measures of habitat utilization, systematic surveys must be conducted throughout the full depth habitat range of each species.

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Appendix I Information on Marine Mammal and Seabird Populations

This appendix contains information on the marine mammal and seabird populations in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) management areas. Much of the information in this appendix is from the *Programmatic Supplemental Environmental Impact Statement for Alaska Groundfish Fisheries* (PSEIS), published by National Marine Fisheries Service (NMFS) in 2004.

I.1 Marine Mammal Populations

Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry *et al.* 1982). In the areas fished by the federally managed groundfish fleets, twenty-six species of marine mammals are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises) (Lowry and Frost 1985). Most species are resident throughout the year, while others seasonally migrate into and out of Alaskan waters.

I.1.1 Potential impacts of fisheries on marine mammals

Direct Mortality from Intentional Take

Commercial harvests of marine mammals have occurred at various times and places, sometimes with devastating impacts on the populations of particular species. In some cases, such as the northern right whale, the species have not recovered to pre-exploitation population levels even though commercial whaling was halted decades ago.

Direct Mortality from Incidental Take in Fisheries

Some types of fisheries are much more likely to catch marine mammals incidentally than others. High seas driftnet fishing killed thousands of mammals before it was prohibited in 1991. Longline and pot fisheries very rarely catch marine mammals directly.

Indirect Effects through Entanglement

The following effects are classified as indirect because the impacts are removed in time and/or space from the initial action although in the analysis, these effects are considered together with the direct effect of incidental take. In some cases, individual marine mammals may be killed outright by the effect. In other cases, individuals are affected in ways that may decrease their chances of surviving natural phenomenon or reproducing successfully. These sub-lethal impacts may reduce their overall “fitness” as individuals and may have population-level implications if enough individuals are impacted.

Although some fisheries have no recorded incidental take of marine mammals, all of them probably contribute to the effects of entanglement in lost fishing gear. Evidence of entanglement comes from observations of animals trailing ropes, buoys, or nets or bearing scars from such gear. Sometimes stranded marine mammals also have evidence of entanglement but it my not be possible to ascertain whether the entanglement caused the injury or whether the corpse picked up gear as it floated around after death. Sometimes an animal is observed to become entangled in specific fishing gear, in which case an incidental take or minor injury may be recorded for that particular fishery, but many times the contributions of individual fisheries to the overall effects of entanglement are difficult to document and quantify.

The Marine Plastic Pollution Research and Control Act of 1987 (33 USC §§ 1901 *et seq.*), implements the provisions relating to garbage and plastics of the MARPOL. These regulations apply to all vessels, regardless of flag, on the navigable waters of the U.S. and in the exclusive economic zone of the U.S. It applies to U.S. flag vessels wherever they are located. The discharge of plastics into the water is prohibited, including synthetic ropes, fishing nets, plastic bags, and biodegradable plastics.

Indirect Effects through Changes in Prey Availability

The availability of prey to marine mammals depends on a large number of factors and differs among species and seasons. Among these factors are oceanographic processes such as upwellings, thermal stratification, ice edges, fronts, gyres, and tidal currents that concentrate prey at particular times and places. Prey availability also depends on the abundance of competing predators and the ecology of prey species, including their natural rates of reproduction, seasonal migration, and movements within the water column. The relative contributions of factors that influence prey availability for particular species and areas are rarely known. Most critical is the lack of information on how events outside an animal's foraging range or in a different season may influence the availability of prey to animals in a particular place and time.

Marine mammal species differ greatly from one another in their prey requirements and feeding behaviors, leading to substantial differences in their responses to changes in the environment. For some species, such as the baleen whales, diets consist largely of planktonic crustaceans or small squid and have no overlap of prey with species that are targeted or taken as bycatch in the groundfish fisheries. For other species, notably Steller sea lions, there is a high degree of overlap between their preferred size and species of prey and the groundfish catch. Many other species are in between, perhaps feeding on the same species but smaller sizes of fish than what is typically taken in the fisheries. Although they may take a wide variety of prey species during the year, many species may depend on only one or a few prey species in a given area and season. In addition, the prey requirements and foraging capabilities of nursing females and subadult animals may be much more restricted than for non-breeding adults, with implications for reproductive success and survival.

The question of whether different types of commercial fisheries have had an effect on the availability of prey to marine mammals has been addressed by examining the degree of direct competition (harvest) of prey and by looking for potential indirect or cascading effects of the fisheries on the food web of the mammals. For marine mammals whose diets overlap to some extent with the target or bycatch species of the fisheries, fishery removals could potentially decrease the density of prey fields or cause changes in the distribution of prey such that the foraging success of the marine mammals is affected. If alternate prey is not available or is of poorer nutritional quality than the preferred species, or if the animal must spend more time and energy searching for prey, reproductive success and/or survival can be compromised. In the case of marine mammals that do not feed on fish or feed on different species than are taken in the fisheries, the removal of a large number of target fish from the ecosystem may alter the predator/prey dynamics and thus the abundance of

another species that is eaten by marine mammals. The mechanisms and causal pathways for many potential food web effects are poorly documented because they are very difficult to study scientifically at sea.

Although reductions in the availability of forage fish to marine mammals have been attributed to both climatic cycles and commercial fisheries, a National Research Council study on the Bering Sea ecosystem (NRC 1996) concluded that both factors probably are significant. Regime shifts are major changes in atmospheric conditions and ocean climate that take place on multi-decade time scales and trigger community-level reorganizations of the marine biota (Anderson and Piatt 1999). Two cycles of warm and cold regimes have been documented in the GOA in the past 100 years, with the latest shift being from a cold regime to a warm regime in 1977. The consequences of this shift on fish and crustacean populations have been documented, including major improvements in groundfish recruitment and the collapse of some high-value forage species such as shrimp, capelin, and Pacific sand lance (Anderson and Piatt 1999). Directed fisheries on forage fish can deepen and prolong their natural low population cycles (Duffy 1983, Steele 1991), with potential effects on marine mammal foraging success. There is some evidence that another regime shift may have begun in 1998 with colder water temperatures and increases in certain forage populations (NPFMC 2002), but the implications for marine mammals are still unclear. Climate change may also affect the dynamics of the ice pack, with serious consequences for the marine mammals associated with the ice pack, such as bowhead whales, the ice seals, and walrus.

Direct Effects through Disturbance by Fishing Vessels

The effects of disturbance caused by vessel traffic, fishing operations, engine noise, and sonar pulses on marine mammals are largely unknown. With regard to vessel traffic, many baleen and toothed whales appear tolerant, at least as suggested by their reactions at the surface. Observed behavior ranges from attraction to the vessel to course modification or maintenance of distance from the vessel. Dall's porpoise, Pacific white-sided dolphins, and even beaked whales have been observed adjacent to vessels for extended periods of time. Conversely, harbor porpoise tend to avoid vessels. However, a small number of fatal collisions with various vessels have been recorded in California and Alaska in the past decade and others likely go unreported or undetected (Angliss *et al.* 2001).

Reactions to some fishing gear, such as pelagic trawls, are poorly documented, although the rarity of incidental takes suggests either partitioning of foraging and fishing areas or avoidance. Given their distribution throughout the fishing grounds, at least some individuals may be expected to occasionally avoid contact with vessels or fishing gear, which would constitute a reaction to a disturbance. Assuming these instances occur, the effects are likely temporary. Sonar devices are used routinely during fishing activity as well as during vessel transit. The sounds produced by these devices may be audible to marine mammals and may thus constitute disturbance sources. Wintering humpback whales have been observed reacting to sonar pulses by moving away (Maybaum 1990, 1993), although few other cases of reaction have been documented.

Indirect Effects through Contamination by Oil Spills

For species such as the pinnipeds and sea otters that spend a substantial amount of time on the surface of the water or hauled out on shore, oil spills pose a significant environmental hazzard, even in small amounts. The toxicological effects of ingested oil, ranging from potential organ damage to weakening of the immune system, are poorly known for most species, especially in regard to chronic low doses. Sea otters are particularly susceptible to oil spills because they depend on their thick fur to protect them from cold water, rather than layers of fat, and oil destroys the insulative properties of their fur. Thousands of sea otters died

over a large expanse of the GOA as a result of the EVOS in 1989 (Garshelis 1997, Garrot *et al.* 1993, DeGange *et al.* 1994). There is very little data on the mortality of marine mammals from the much smaller volumes of oil that are more typical of marine vessel spills, resulting from fuel transfer accidents and bilge operations.

I.1.2 Statutory protection for marine mammals

There are two major laws that protect marine mammals and require the North Pacific Fishery Management Council (Council) to address their conservation in the FMPs . The first is the Marine Mammal Protection Act of 1972 (amended 1994) (MMPA). Management responsibility for cetaceans and pinnipeds other than walrus is vested with NMFS Protected Resources Division (PRD). The USFWS is responsible for management of walrus and sea otters. The goal of the MMPA is to provide protection for marine mammals so that their populations are maintained as a significant, functioning element of the ecosystem. The MMPA established a moratorium on the taking of all marine mammals in the United States with the exception of subsistence use by Alaska Natives. Under the authority of this Act, NMFS PRD monitors populations of marine mammals to determine if a species or population stock is below its optimum sustainable population. Species that fall below this level are designated as "depleted." Populations or stocks (e.g., the western stock of Steller sea lions) listed as threatened or endangered under the ESA, are automatically designated as depleted under the MMPA.

The ESA was enacted in 1973 and reauthorized in 1988. This law provides broad protection for species that are listed as threatened or endangered under the Act. The species listed under the ESA that spend all or part of their time in the BSAI/GOA and that may be affected by the groundfish fisheries are included in the table below. There are eight whale species, and two distinct population segments of Steller sea lions.

Listed Species	Population or Distinct Population Segment (DPS)	Latin Name	Status
Blue whale	North Pacific	*Balaenoptera musculus*	Endangered
Bowhead whale	Western Arctic	*Balaena mysticetus*	Endangered
Fin whale	Northeast Pacific	*Balaenoptera physalus*	Endangered
Humpback whale	Western and Central North Pacific	*Megaptera novaeangliae*	Endangered
Right whale	North Pacific	*Eubalaena japonica*	Endangered
Sei whale	North Pacific	*Balaenoptera borealis*	Endangered
Sperm whale	North Pacific	*Physeter macrocephalus*	Endangered
Gray whale	Eastern Pacific	*Eschrichtius robustus*	Delisted
Steller sea lion	Western Alaska DPS	*Eumetopias jubatus*	Endangered
Steller sea lion	Eastern Alaska DPS	*Eumetopias jubatus*	Threatened

The mandatory protection provisions of the ESA have led to numerous administrative and judicial actions and has brought the issue of fisheries/sea lion interactions under intense scrutiny. Section 7(a)(2) of the ESA requires federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of its designated critical habitat. For federal fishery management actions, the action agency, NMFS Sustainable Fisheries Division, is required under Section7(a)(2) to consult with the Steller sea lion expert agency, NMFS PRD, to determine if the proposed action may affect Steller sea lions or their critical habitat. If the proposed action may affect Steller sea lions or its designated critical habitat, formal consultation is required. Formal consultation is a process between the action and expert

agency that determines whether a proposed action is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. The process begins with the action agency's assessment of the effects of their proposed action on listed species and concludes with the issuance of a "Biological Opinion" (BiOp) by the expert agency. A biological opinion is a document which includes: a) the opinion of NMFS PRD as to whether or not a federal action (such as federally authorized fisheries) is likely to jeopardize the continued existence of listed species or adversely modify designated critical habitat; b) a summary of the information on which the opinion is based; and c) a detailed discussion of the effects of the action on listed species or designated critical habitat. If the BiOp concludes that the proposed action is likely to jeopardize the continued existence of threatened or endangered species or adversely modify critical habitat, then the expert agency recommends. Reasonable and Prudent Alternatives (RPAs) to avoid the likelihood of "jeopardy" or "adverse modification" of critical habitat. The resulting legal requirements limit the Council from adopting FMP policies that result in a jeopardy finding for the Steller sea lions.

I.1.3 Consideration of marine mammals in groundfish fishery management

In order to fulfill their oversight responsibilities under the MMPA, NMFS PRD and USFWS have developed appropriate survey methodologies to census the various species of marine mammals. The results of these surveys, and other factors that affect the status of each species, are published in an annual "Marine Mammal Stock Assessment" report that is available on the NMFS national website (www.nmfs.noaa.gov).

Some species are much more difficult to census accurately than others, so there is a great deal of variation in the uncertainty of various population estimates. In addition, the huge expanses over which many species traverse and the remoteness of their habitats make surveys logistically difficult and expensive. For budgetary and logistical reasons, surveys of most species are not carried out every year and survey effort is prioritized for species of management concern. As a result, population estimates for some species may be outdated and trend information may not exist.

NMFS PRD requires all commercial fisheries in the U.S. EEZ to report the incidental take and injury of marine mammals that occur during their operations (50 CFR 229.6). In addition to self-reported records, which NMFS PRD considers to be negatively biased and under representing actual take levels, certified observers are required in some fisheries to provide independent monitoring of incidental take as well as other fishery data.

Management measures are in place in the BSAI and GOA groundfish fisheries to protect Steller sea lions. These protection measures were deemed necessary based on the hypothesis that the continued decline of the western stock of the Steller sea lion is due to nutritional stress and that groundfish fisheries contribute to this stress by competing with sea lions for their key prey species. Management measures were specifically developed to reduce competitive interaction between Steller sea lions and the groundfish fisheries (NMFS 2001a). Mitigation efforts have focused on protecting the integrity of food supplies near rookeries and haulouts. Competitive interactions with the fishery may have the greatest effect on juvenile Steller sea lions between the time they are weaned and the time they reach adult size and foraging capability as the diving capacity of juveniles (and thus available foraging space) is less than that of adults. Adult females may also be susceptible to nutritional stress due to reduced prey availability in the vicinity of rookeries because of the limited foraging distribution and increased energetic demands when caring for pups. Specifically, the intent of the protection measures was to avoid competition around rookeries and important haulouts with extra precaution in the winter, and to disperse the fisheries outside of those time periods and areas.

Section 118 of the MMPA (50 CFR 229.2) requires all commercial fisheries to be placed into one of three categories, based on the frequency of incidental take (serious injuries and mortalities) relative to the value of potential biological removal (PBR) for each stock of marine mammal. PBR is defined as the maximum number of animals, not including natural mortalities, that may be removed from a stock while allowing that stock to reach or maintain its optimum sustainable population. In order to categorize each fishery, NMFS PRD first looks at the level of incidental take from all fisheries that interact with a given marine mammal stock. If the combined take of all fisheries is less than or equal to 10 percent of PBR, each fishery in that combined total is assigned to Category III, the minimal impact category. If the combined take is greater than 10 percent of PBR, NMFS PRD then looks at the individual fisheries to assign them to a category. Category I designates fisheries with frequent incidental take, defined as those with takes greater than or equal to 50 percent of PBR for a particular stock; Category II designates fisheries with occasional serious injuries and mortalities, defined as those with takes between one percent and 50 percent of PBR; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities, defined as those with take less than or equal to one percent of PBR. Owners of vessels or gear engaging in Category I or II fisheries are required to register with NMFS PRD to obtain a marine mammal authorization in order to lawfully take a marine mammal incidentally in their fishing operation (50 CFR 229.4). In Alaska, this registration process has been integrated into other state and federal permitting programs to reduce fees and paperwork. Owners of vessels or gear engaging in Category III fisheries are not required to register with NMFS PRD for this purpose. Every year, NMFS PRD reviews and revises its list of Category I, II, and III fisheries based on new information and publishes the list in the Federal Register.

Under provisions of the MMPA, NMFS PRD is required to establish take reduction teams with the purpose of developing take reduction plans to assist in the recovery or to prevent the depletion of strategic stocks that interact with Category I and II fisheries. A “strategic” stock is one which: 1) is listed as endangered or threatened under the ESA, 2) is declining and likely to be listed as threatened under the ESA, 3) is listed as depleted under the MMPA, or 4) has direct human-caused mortality which exceeds the stock’s PBR.

The immediate goal of a take reduction plan is to reduce, within six months of its implementation, the incidental serious injury or mortality of marine mammals from commercial fishing to levels less than PBR. The long-term goal is to reduce, within five years of its implementation, the incidental serious injury and mortality of marine mammals from commercial fishing operations to insignificant levels approaching a zero serious injury and mortality rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional FMPs. Take reduction teams are to consist of a balance of representatives from the fishing industry, fishery management councils, state and federal resource management agencies, the scientific community, and conservation organizations. Fishers participating in Category I or II fisheries must comply with any applicable take reduction plan and may be required to carry an observer onboard during fishing operations.

In 2002, all of the Alaska groundfish fisheries (trawl, longline, and pot gear in the BSAI and GOA) were listed as Category III fisheries (67 FR 2410). However, NMFS PRD has recently proposed that the BSAI groundfish trawl fishery be elevated to Category II status based on a review of Observer Program records of marine mammal incidental take from 1990-2000 (68 FR 1414). According to the records, total incidental take of all fisheries is greater than 10 percent of PBR for the Alaska stocks of western and central North Pacific humpback whales, resident killer whales, transient killer whales, and the western stock of Steller sea lions. Based on the incidental take of these species relative to their respective PBRs, and some other considerations in the case of humpback whales, NMFS PRD determined in their “Tier 2” analysis that the BSA groundfish trawl fishery posed a modest risk to these species. In addition, a number of state-managed

salmon drift and set gillnet fisheries are listed in Category II, including those in Bristol Bay, Aleutian Islands, Alaska Peninsula, Kodiak, Cook Inlet, PWS, and Southeast Alaska. NMFS PRD has recently proposed reclassifying the Cook Inlet drift and set gillnet fisheries from Category II to Category III (68 FR 1414).

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I.2 Seabird Populations

Over 70 species of seabirds occur over waters off Alaska and could potentially be affected by direct and indirect interactions with the Bering Sea Aleutian Islands and Gulf of Alaska (BSAI and GOA) groundfish fisheries. Thirty-eight of these species regularly breed in Alaska and waters of the Exclusive Economic Zone (EEZ). More than 1,600 seabird colonies have been documented, ranging in size from a few pairs to 3.5 million birds (USFWS 2000). Breeding populations of seabirds are estimated at approximately 48 million birds and non-breeding migrant birds probably account for an additional 30 million birds (USFWS 2000). Most of the migrant birds are present only during the summer months (May through September) although some non-breeding albatross have been sighted at all months of the year (USFWS 1999). The distributions of species that breed in Alaska are well known in summer but for some species winter distributions are poorly documented or completely unknown.

I.2.1 Potential impacts of fisheries on seabird species

Potential fisheries impacts on a given seabird species could theoretically be measured by changes in survival or reproductive rates and ultimately by changes in the population. For all of these biological parameters, one would expect fluctuations in time and space as part of "normal" or natural conditions. The ability to

distinguish these natural fluctuations from potential human-caused fluctuations requires reasonably accurate measurements of several parameters over a long time period and in many different areas. Although the United States Fish and Wildlife Service (USFWS) surveys a number of large seabird colonies every year, present population estimates for most species are not precise enough to detect anything but the largest fluctuations in numbers. This is especially true for species that do not nest in dense concentrations. For some species, like the burrow and crevice-nesting alcids and storm-petrels, field methods for censussing populations are not available and require additional budgetary support for development (Dragoo *et al.* 2001).

Seabirds can interact with fisheries in a number of direct and indirect ways. Direct effects occur at the same time and place as the fishery action. Seabirds are attracted to fishing vessels to feed on prey churned up in the boat's wake, escaping fish from trawl nets, baited hooks of longline vessels, and offal discharged from trawl, pot, and longline vessels. In the process of feeding, seabirds sometimes come into contact with fishing gear and are caught incidentally. A direct interaction is usually recorded as the injury or killing of a seabird and is referred to as an "incidental take". Information on the numbers of birds caught incidentally in the various gear types comes from the North Pacific Groundfish Observer Program (Observer Program) and is summarized in the seabird section of "Ecosystem Considerations for 2003" report (NPFMC 2002, Tables 8, 9, 11, and 12).

Another direct fishery effect is the striking of vessels and fishing gear by birds in flight. Some birds fly away without injury but others are injured or killed and are thus considered incidental take. The Observer Program does not collect data on vessel strikes in a systematic way but there are some records of bird-strikes that have been collected on an opportunistic basis. These sporadic observations of vessel strikes from 1993-2000 have been entered into the Observer Notes Database, which is maintained by the USFWS, but have only received preliminary statistical analysis (seabird section of "Ecosystem Considerations for 2003", NPFMC 2002). Indirect effects refer to either positive or negative impacts on the reproductive success or survival of seabirds that may be caused by the fishery action but are separated in time or geographic location. The indirect effect which has received the most attention is the potential impact of fisheries competition or disturbance on the abundance and distribution of prey species that seabirds depend on, thus affecting seabird foraging success. Of particular note would be those effects on breeding piscivorous (fish-eating) seabirds that must meet the food demands of growing chicks at the nest colony. Reproductive success in Alaskan seabirds is strongly linked to the availability of appropriate fish (Piatt and Roseneau 1998, Suryan *et al.* 1998a, Suryan *et al.* 2000, Golet *et al.* 2000). Although seabird populations remain relatively stable during occasional years of poor food and reproduction, a long-term scarcity of forage fish leads to population declines. Other potential indirect effects on seabirds include physical disruption of benthic foraging habitat by bottom trawls, consumption of processing wastes and discarded offal, contamination by oil spills, introductions of nest predators (i.e., rats) to nesting islands, and ingestion of plastics released intentionally or accidentally from fishing vessels. Some of these potential impacts are related more to the presence of fishing vessels rather than the process of catching fish.

1.2.2 Statutory protection for seabirds

There are two major laws that protect seabirds and require the Council to address seabird conservation in their Fishery Management Plans (FMPs). The first is the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended over the years. This law pertains to all of the seabird species found in the BSAI/GOA area (66 FR 52282) and governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts and nests. The definition of "take" in the Migratory Bird Treaty Act (MBTA) is "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture,

or collect" (50 CFR 10.12). In a fishery context, "take" refers to birds killed or injured during commercial fishing operations, whether in fishing gear or by striking some part of a vessel. Under the MBTA, take of migratory birds is illegal, even if it is accidental or inadvertent, unless permitted through regulations (such as hunting regulations or permit exemptions). Thus far, only certain forms of intentional take have been legalized in these ways. There are currently no regulations to allow unintentional take. The USFWS and Department of Justice are vested with enforcement discretion, which has been used in lieu of a permitting program. Enforcement has focused on those who take birds with disregard for the law and the impact of their actions on the resource, particularly where effective conservation measures are available but have not been applied ("Fact sheet" on MBTA, K. Laing, USFWS). Executive Order 13186 (66 FR 3853-3856), "Responsibilities of Federal Agencies to Protect Migratory Birds," which was signed by the President on January 10, 2001, directs federal agencies to develop and implement a "Memorandum of Understanding" with the USFWS to promote the conservation of migratory birds affected by their actions, including mitigation of activities that cause unintentional take. National Marine Fisheries Service (NMFS) and USFWS are currently developing this framework document which will incorporate seabird protection measures designed for specific fisheries (K. Rivera, NMFS National Seabird Coordinator, personal communication).

The second law is the Endangered Species Act (ESA) which provides broad protection for species that are listed as threatened or endangered. Presently there are three species listed under the ESA that spend all or part of their time in the BSAI/GOA and that may be affected by the groundfish fisheries: short-tailed albatross (endangered), Steller's eider (threatened), and spectacled eider (threatened). Section 7(a)(2) of the ESA requires federal agencies to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of habitat important to the continued existence of the species (Critical Habitat). For ESA listed seabirds, the USFWS is the agency responsible for conducting an assessment of the proposed action and preparing the appropriate Section 7 document, a "Biological Opinion" (BiOp). If the BiOp concludes that the proposed action is likely to jeopardize the continued existence of threatened or endangered species or adversely modify its Critical Habitat, then the agency must develop Reasonable and Prudent Alternatives (RPAs) to minimize or mitigate the effect of the action. Even if a "no jeopardy" determination is made, as has been done for all three listed species in the BSAI/GOA, the agency may require and/or recommend that certain mitigation measures be adopted. In addition, the agency may establish a threshold number of incidental takes that would trigger a new Section 7 consultation to reexamine the required mitigation measures. In the case of the short-tailed albatross, the number of incidental takes that could be reasonably expected, given the designated mitigation measures, has been adopted as a threshold value and is described in the Incidental Take Statement attached to the BiOp (USFWS 1999). These provisions of the ESA, as applied to the short-tailed albatross, have played a major role in the development of seabird protection measures for the longline sector of the BSAI/GOA groundfish fishery.

USFWS may designate Critical Habitat areas for each species under the ESA if it can determine that those areas are important to the continued existence of the species. Critical Habitat may only be designated in U.S. territory, including waters of the EEZ. Short-tailed albatross do not nest in U.S. waters but have been sighted throughout the BSAI/GOA area. No Critical Habitat has been designated for this species. Spectacled and Steller's eiders each have designated Critical Habitats in the BSAI where they concentrate in winter and during flightless molting periods (66 FR 9146 and 66 FR 8850 respectively; February 2001). Critical Habitat designations do not automatically restrict human activities like fishing. They do require the lead agency, in this case the USFWS, to monitor activities that may degrade the value of the habitat for the listed species.

I.2.3 Consideration of seabirds in groundfish fishery management

Seabird protection measures in the BSAI/GOA groundfish fisheries were initiated in the 1990s and have focused primarily on collecting seabird/fishery interaction data and on requiring longliners to use specific types of gear and fishing techniques to avoid seabird incidental take. This emphasis on longline gear restrictions has been driven by conservation concerns for the endangered short-tailed albatross as well as other species. Longline vessels over 26 ft LOA are required to use either single or paired streamer lines (or in some cases for smaller vessels, a buoy bag line) to reduce incidental take of seabirds.

Observers collect incidental take data in the trawl and pot sectors of the fishery. USFWS and the trawl sector of the fishing industry are collaborating on research into minimizing the effects of the trawl "third wire" (a cable from the vessel to the trawl net monitoring device) on incidental take of seabirds. However, there have been no regulatory or FMP-level efforts to mitigate seabird incidental take in the trawl and pot sectors.

For species listed as threatened or endangered under the ESA, the USFWS may establish a threshold number of incidental takes that are allowed before mitigation measures are reviewed and perhaps changed. Although this is sometimes viewed as a "limit" on the number of birds (e.g., short-tailed albatross) that can be taken, the result of exceeding this threshold number is a formal consultation process between NMFS and USFWS, not an immediate shutdown of the fishery.

Another management tool that may affect incidental take of seabirds is the regulation of who is allowed to fish. Limited entry and rationalization programs such as Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) may impact seabird incidental take if the number or size of fishing vessels changes because regulations on protective measures are based on the size of the vessel. Since different types of fishing gear are more prone to take different kinds and numbers of seabirds, allocation of TAC among the different gear sectors can also have a substantial impact on incidental take.

Food web impacts can be addressed with several management tools. The Council has designated particular species and size classes of fish as being important prey for seabirds and marine mammals and has prohibited directed fisheries on these forage fish (BSAI FMP Amendment 36 and GOA Amendment 39). The Council may also manage the allocation, biomass, and species of fish targeted by the industry through the total allowable catch (TAC)-setting process. These factors impact the food web and could thus alter the availability of food to seabirds. While more information is available for the dynamics of fish populations than of invertebrate prey, food web interactions are very complicated and there is a great deal of scientific uncertainty regarding the specific effects of different management options.

Each of the management tools listed above requires reliable data to monitor the extent of fishery interactions and the effectiveness of mitigation efforts in accordance with management policy objectives. The Council established the Observer Program in order to collect fishery information. Beginning in 1993, the Observer Program was modified to provide information on seabird/fishery interactions. Observers are presently required on vessels 125 feet (ft) or more in length overall (LOA) for 100 percent of their fishing days and aboard vessels 60-124 ft LOA for 30 percent of their fishing days. Vessels less than 60 ft LOA do not have to carry observers.

Observers receive training in seabird identification, at least to the level of being able to place birds into the categories requested by the USFWS. Some of these categories identify individual species and others lump species under generalized groups, e.g., "unidentified alcids." In many cases, birds that were caught as the

gear was being deployed have soaked at depth for hours and have been eaten by invertebrates. By the time they are retrieved on board they may be identifiable only to a generalized group level. NMFS is currently working to improve the training of its observers in identifying birds from their feet and bills, which are often the only parts of the bird that are recognizable (S. Fitzgerald, Observer Program, personal communication). When the Observer Program data is analyzed and reported (as in the Ecosystem Considerations reports in *Stock Assessment and Fishery Evaluation* documents), individual species with relatively few records are often lumped into larger categories. For example, the "gull" category contains many "unidentified gulls" but also various numbers of five different gull species that observers have identified to species. Similarly, the "alcid" group contains separate records of seven different alcid species.

For those vessels operating without observers, regulations require captains to report the taking of any ESA-listed species and to retain and deliver the body to USFWS for positive identification. Unfortunately, such self-reporting is unreliable due to the inability or unwillingness of some crews to identify and retain species of concern. Other existing fishery record-keeping and reporting requirements provide data on the distribution of fishing effort which could potentially be used in conjunction with directed research to analyze potential food web and seabird population impacts.

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