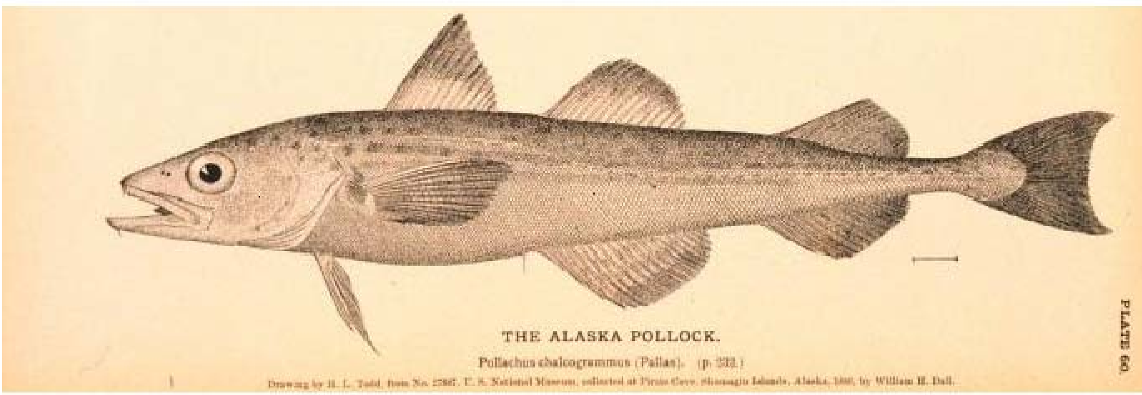
Alaska Groundfish Harvest Specifications
DRAFT
Environmental Impact Statement



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Alaska Groundfish Harvest Specifications

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Environmental Impact Statement (DEIS)

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Abstract: The DEIS provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative harvest strategies for the federally managed groundfish fisheries in the Gulf of Alaska and the Bering Sea and Aleutian Islands management areas. The DEIS examines alternative harvest strategies that comply with Federal regulations, the Fishery Management Plans for the groundfish fisheries, and the Magnuson-Stevens Fishery Conservation and Management Act. These alternative harvest strategies are applied to the best available scientific information to derive the total allowable catch estimates for the groundfish fisheries. This document addresses the requirements of the National Environmental Policy Act.

Public Comments Due: October 23, 2006

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Executive Summary

The groundfish fisheries in Federal waters off Alaska are managed under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area and the Fishery Management Plan for Groundfish of the Gulf of Alaska (FMPs). In the Gulf of Alaska (GOA) and Bering Sea and Aleutian Islands (BSAI), groundfish harvests are managed subject to annual limits on the amounts of each species of fish, or of each group of species, that may be taken. The annual limits are referred to as "harvest specifications," and the process of establishing them is referred to as the "specifications process."

The proposed action would adopt a harvest strategy to determine the harvest specifications for the federally managed groundfish fisheries in the GOA and BSAI management areas. The U.S. Secretary of Commerce (Secretary) approves the harvest specifications based on the recommendations of the North Pacific Fishery Management Council (Council). The National Marine Fisheries Service (NMFS) manages the groundfish fisheries.

The harvest strategies are applied to the best available scientific information to derive harvest specifications, which include total allowable catch (TAC) and prohibited species catch (PSC). The Council's Groundfish Plan Teams use stock assessments to calculate biomass, overfishing levels, and acceptable biological catches (ABC), for each species or species group for specified management areas. Overfishing levels and ABCs are published with the harvest specifications, and provide the foundation for the Council and NMFS to develop the TACs. Overfishing levels and ABC amounts reflect fishery science, applied in light of the requirements of the FMPs.

Purpose and Need

Chapter 1 describes the proposed action and its purpose and need. The proposed action would establish a harvest strategy for the BSAI and GOA groundfish fisheries. A harvest strategy is needed for the management of the groundfish fisheries and the conservation of marine resources, as required by the Magnuson-Stevens Act and as described in the management policy, goals, and objectives in the FMPs.

The purpose of the harvest strategy is to provide for orderly and controlled commercial fishing for groundfish (including Community Development Quota (CDQ) fishing), promote sustainable incomes to the fishing, fish processing, and support industries; support sustainable fishing communities, and provide sustainable flows of fish products to consumers. The harvest strategy balances groundfish harvest in the fishing year with ecosystem needs (such as non-target fish stocks, marine mammals, seabirds, and habitat).

Alternatives

Chapter 2 describes and compares five alternative harvest strategies. The five alternatives are summarized as follows:

Alternative 1: Set TACs to produce harvest levels equal to the maximum permissible ABCs, unless the sum of the TACs is constrained by the Optimum Yield (OY) established in the FMPs.

Alternative 2: (Status Quo; Preferred) Set TACs that fall within the range of ABCs recommended by the Council's Groundfish Plan Teams and TACs recommended by the Council.

Alternative 3: For stocks with a high level of scientific information, set TACs to produce harvest levels equal to the most recent five-year average actual fishing mortality rates. For stocks with insufficient scientific information, set TACs equal to the most recent five-year average actual catch.

Alternative 4: Set low and spatially explicit TACs for rockfish species. Reduce all other TACs by a proportion that does not vary across species, so that the sum of all TACs, including rockfish TACs, is equal to the lower bound of the OY for a given area (1,400,000 mt in the BSAI and 116,000 mt in the GOA). This alternative sets TACs to sum to the lower OY range.

Alternative 5: (No Action) Set TACs at zero. This is the no action alternative, but does not reflect status quo.

Except for the no action alternative (Alternative 5), the alternatives analyzed in this EIS are consistent with the goals of the FMPs and existing regulations. The constraints for setting harvest specifications under the FMPs are (1) setting ABCs according to FMP procedures, (2) setting TAC less than or equal to ABC for all target and other species categories, and (3) setting the sum of the TACs to be within OY range. The following is a brief comparison of the TACs that would result from each of the alternative harvest strategies.

- **Alternative 1:** In the BSAI, the sum of the ABCs would exceed the OY. Under Alternative 1, therefore, BSAI TACs have been set equal to their Alternative 2 levels. In the GOA, Alternative 1 involves increased TACs for many species. However, in many cases these increased TACs are not likely to lead to proportionate increases in harvest. Large increases in TACs for arrowtooth flounder may be difficult to market. In other instances, there is a likelihood that large increases in TACs for species that are currently constrained by PSC bycatch, or that are close to levels at which PSC constraints would be binding, would not be fully harvested.

- **Alternative 2:** Alternative 2 would provide for TAC levels that would be generally close to those of the status quo. In the BSAI, TACs have been set so that they sum to the maximum OY. In the GOA, TACs are set below the maximum OY level.

- **Alternative 3:** Alternative 3 would result in lower fish production compared to Alternatives 1 or 2. In the BSAI, Alternative 3 would result in total TAC levels similar to Alternative 4, however, a greater proportion of the harvest would be pollock. In the GOA, Alternative 3 would result in total TAC levels larger than Alternative 4.

- **Alternative 4:** Alternative 4 was developed to respond to requests received during scoping to explore the impacts of setting low harvest rates for groundfish species, including important prey species, and setting low and spatially explicit TACs for rockfish species that are long-lived and late to mature. Alternative 4 would result in somewhat less total fish production than Alternatives 1 or 2. Alternative 4 would result in a similar total BSAI TAC and a reduced total GOA TAC as under Alternative 3. However, the TACs of individual groundfish species vary between Alternative 3 and Alternative 4.

- **Alternative 5:** Under Alternative 5, there would be no groundfish fisheries in the BSAI or GOA. Alternative 5 was developed to explore the no action alternative, one of the fundamental requirements of an EIS.

Summary of the environmental consequences of the alternatives

The EIS evaluates the alternatives for their effects on resources, species, and issues within the action area. The environmental consequences of each alternative for target species, non-specified species, forage species, prohibited species, marine mammals, seabirds, Essential Fish Habitat, ecosystem relationships, the economy, and environmental justice are assessed in Chapters 4 through 13 of this EIS.

Target species

Chapter 4 analyzes the impacts of the alternatives on target species. Section 4.1 analyses the impacts on gadoids, flatfish, and groundfish species other than rockfish, while Section 4.2 analyzes impacts on rockfish. The analysis examines the impacts of the alternative harvest strategies on target species mortality, genetic structure, reproductive success, prey availability, and habitat.

The alternative harvest strategies under consideration for gadoids, flatfish, and groundfish species other than rockfish, are not expected to (1) jeopardize the capacity of the stocks to produce maximum sustainable yield on a continuing basis, (2) alter the genetic sub-population structure such that it jeopardizes the ability of the stocks to sustain themselves at or above the minimum stock size threshold (MSST) or experience overfishing, (3) decrease reproductive success in a way that jeopardizes the ability of the stocks to sustain themselves at or above the MSST, (4) alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the MSST or experience overfishing, or (5) disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the MSST or prevent overfishing.

Rockfish stocks were grouped into Pacific ocean perch, northern rockfish, GOA dusky rockfish, shortraker rockfish, rougheye rockfish, and ‘other’ rockfish species for the purposes of evaluation. Rockfish with ABCs determined using the FMP Tier 3 rules do not appear to be overfished under the status quo. It is not possible to make this type of determination for other rockfish species. Status quo genetic impacts are unknown. Status quo impacts on breeding and spawning are small or unknown. Impacts on rockfish prey availability are likely to be small. Status quo impacts on rockfish habitat are likely to be small in general under the alternatives. For some species, impacts of bottom trawling on habitat features used as refugia by juvenile rockfish are possible. Localized impacts may occur for some species. Impacts under Alternatives 3 and 4 would be less than those under Alternative 2. There would be no adverse impacts under Alternative 5. Impacts under Alternative 1 would, in general, be similar to those under Alternative 2.

Non-specified species

Chapter 5 analyzes the impacts of the alternatives on non-specified species. These are species that are not defined in the BSAI or GOA FMPs as target, other, forage, or prohibited species. Grenadier, taken in longline fisheries, dominate non-specified species harvests in the GOA. Grenadier, jellyfish, and starfish dominate non-specified species harvests in the BSAI. The analysis examines the impacts of the alternative harvest strategies on non-specified species mortality, genetic structure, reproductive success, prey availability, and habitat. Status quo grenadier harvests are believed to be below the ABC levels, if ABCs were established for this species. Harvests of jellyfish and starfish in relation to biomass are not well understood, although fishing bycatch mortality as a source of overall mortality is believed to be small for jellyfish and brittle stars. Fishing mortality may be a more important component of overall mortality for sea stars. Brittle stars may be subject to mortality from the action of gear on the bottom; this source of mortality would not be reflected in bycatch mortality estimates. Status quo groundfish fishing impacts on the genetic structure of populations, reproductive success, prey availability, and habitat are unknown. Impacts of Alternatives 3, 4, or 5 would be less than those of Alternative 2. Impacts of Alternative 1 would be the same as Alternative 2.

Forage fish species

Chapter 6 analyzes the impacts of the alternatives on forage fish species as listed in the BSAI and GOA FMPs. Most forage fish bycatch consists of capelin or eulachon taken in pollock trawling operations. The analysis examines the impacts of the alternative harvest strategies on forage species mortality, genetic structure, reproductive success, prey availability, and habitat. Bycatch in recent years has ranged from 30 mt to 80 mt in the BSAI, and from 23 mt to 1,000 mt in the GOA. Status quo impacts of smelt bycatch are believed to be small in comparison with biomass (perhaps one to two percent). Status quo groundfish fishing impacts on the genetic structure of populations, reproductive success, prey availability, and habitat are all believed to be small. Impacts of Alternatives 3, 4, or 5 would be less than those of Alternative 2. Impacts of Alternative 1 would be the same as Alternative 2 in the BSAI, but somewhat higher in the GOA. Alternative 1 impacts in the GOA should still be small. However, status quo prey and habitat mediated impacts on sandfish, one of the forage fish species, are described as unknown.

Prohibited species

Chapter 7 analyzes the impacts of the alternatives on prohibited species. Prohibited species in the groundfish fisheries include Pacific salmon species and stocks (Chinook, coho, sockeye, chum, and pink), steelhead trout, Pacific halibut, Pacific herring, red king crab, Tanner crab, and snow crab. The analysis examines the impacts of the alternative harvest strategies on prohibited species mortality, genetic structure, reproductive success, prey availability, and habitat. The impacts of the alternatives on prohibited species are reduced by existing management measures such as prohibited species catch limitations on a year-round and seasonal basis, year-round and seasonal area closures, gear restrictions, and an incentive plan to reduce the incidental catch of prohibited species by individual fishing vessels. These management measures minimize adverse impacts to prohibited species. The amounts of crab and herring taken under any of the groundfish harvest alternatives considered are so low that they would have minor impacts on the stocks of these species. The prohibited species catch limits for herring are never reached. When area prohibited species catch limits are reached, limits help reduce adverse impacts to stocks by closing the fisheries in those areas. Salmon bycatch is likely to be higher under Alternatives 1 and 2 compared to Alternatives 3 and 4 based on the higher pollock TAC, especially in the BSAI. Not enough information is available to determine the impact of the bycatch on salmon stock biomass but the Council is in the process of developing additional fishery management measures to reduce salmon bycatch in the pollock fishery of the BSAI.

Marine mammals

Chapter 8 analyzes the impacts of the alternatives on marine mammals. This analysis determines (a) whether takings, prey competition, or disturbance occur under each alternative, and (b) if they do occur, the relative level of impact. Incidental takes of marine mammals would occur under all alternatives, except Alternative 5. Under all of the alternatives, potential take in the groundfish fisheries is well below the potential biological removal for all marine mammals, except killer whales and humpback whales. This means that predicted take would be below the maximum number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. Under all of the alternatives, competition for key prey species is not likely to constrain foraging success of marine mammal species or cause population declines. The exceptions to this are the Steller sea lions and fur seals for which potential prey competition with the groundfish fisheries may be a concern. Alternatives 1 and 2 have a greater potential for competition for prey compared to Alternatives 3 and 4 due to higher pollock TACs. Disturbance of mammals under Alternatives 1 through 4 is not likely to cause population declines. Alternative 5 would have the least potential for incidental takes and no possibility of disturbance or competition for prey species for all marine mammals.

Seabirds

Chapter 9 analyzes the impacts of the alternatives on seabirds. Seabirds were grouped into northern fulmars, short-tailed albatross, spectacled and Steller's eiders, albatrosses and shearwaters, piscivorous seabird species, and all other seabird species for the purposes of evaluation. The analysis evaluates the impacts of the alternative harvest strategies on seabird takings, prey availability, and ability to exploit benthic habitat. In general, known direct status-quo take levels appear to be small in comparison with populations. Several sources of take are unknown. In general, status quo impacts on seabird prey are believed to be small. Guillemots and cormorants may have a lesser ability to forage widely, and may be susceptible to localized depletion of prey. Status quo impacts on benthic habitat exploited by some benthic feeders appear to be small. In some instances there may be overlap between alcid, gull, and cormorant foraging areas. Impacts under Alternatives 3 and 4 would be less than those under Alternative 2. There would be no adverse impacts under Alternative 5. Impacts under Alternative 1 would, in general, be the same as those under Alternative 2 in the BSAI, and somewhat higher in the GOA.

Essential fish habitat

Chapter 10 analyzes the impacts of the alternatives on EFH and includes references to EFH species in Chapter 4. The existing EFH conservation measures, including Habitat Areas of Particular Concern sites and other area closures and gear restrictions, are established in the FMPs. These measures protect areas of ecological importance for the long-term sustainability of managed species from fishing impacts under all of the alternatives. Alternative 2 would implement a harvest strategy that would produce harvest levels that are similar to those evaluated in the EFH EIS and would likely have similar impacts on EFH. NMFS has prepared an EFH Assessment, Chapter 10, to discuss potential adverse effects to EFH from alternative harvest strategies. The assessment determines that impacts under all alternatives are predicted to be minimal and not adverse, although some may be persistent, because the analysis in the EFH EIS found no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. Due to the many considerations, the assessment concludes no action is needed to further conserve EFH.

Ecosystem

Chapter 11 analyzes the impacts of the alternatives on the ecosystem. Ecosystem impacts were evaluated with respect to predator-prey relationships, energy flow and balance, and diversity. The status quo is likely to be characterized by degree of spatial and temporal concentration of a fishery's impact on forage species, removal of top predators, and introduction of non-native species that are similar to those seen in the recent past. Biomass of pollock in the GOA and BSAI, and of Atka mackerel in the AI, all three sources of pelagic forage, are expected to decline in 2007 and 2008 under the status quo. Similarly, the level of energy removal, and the extent to which energy is redirected in the ecosystem (through discards of offal, for example) are expected to be similar to levels from the recent past under the status quo. The degree of energy removal may actually decline with TACs that are lower than those in the recent past. Fishery impacts on species' functional and genetic diversity are expected to remain at similar levels. Impacts under Alternative 1 would be the same as status quo in the BSAI, and may be higher in the GOA. Much of the increase in GOA TACs under Alternative 1 would come in the form of increased flatfish TACs, and halibut PSC limits are likely to constrain the industry from fully harvesting these. Impacts of Alternatives 3 or 4 would be expected to be less than those of Alternative 2. Alternative 5 would have no adverse impact.

Social and economic impacts

Chapter 12 analyzes the social and economic impacts of the alternatives. Chapter 12 described the impacts of the alternatives on a wide range of measures. Data and model limitations preclude quantitative estimation of most measures.

Alternative 2 is associated with 2007-2008 harvests and gross revenues that are at lower levels than those under the status quo strategy in 2006. BSAI non-CDQ revenues are 4 to 10 percent less than in 2006 under Alternative 2, BSAI CDQ revenues are 5 to 20 percent less, and GOA revenues are 10 to 20 percent less. Projected declines in pollock, Pacific cod, and Atka mackerel ABCs are important factors in the BSAI revenue reductions, while declines in pollock, Pacific cod, and sablefish ABCs, are important in the GOA. BSAI CDQ revenues would drop more than non-CDQ revenues because of the much greater importance of pollock as a source of CDQ revenues.

Alternative 1 ABCs may be higher than those under Alternative 2. The sum of Alternative 1 TACs may thus be higher, unless the OY constraint would be binding under Alternaive 2. This is the case in the BSAI. Alternative 1 is associated with the same impacts as Alternative 2 in the BSAI, but with somewhat higher catch and gross revenue levels than Alternative 2 in the GOA. While increased pollock TACs are likely to be harvested, it is not clear that catch and revenue increases would be associated with increases in flatfish TACs. Most GOA TAC increases would be in flatfishes; however, halibut PSC limits are likely to prevent fishermen from actually increasing harvests of many of these species.

Alternatives 3 and 4 are associated with harvest levels and gross revenues that are considerably lower than those in the recent past, and those under Alternative 2. These alternatives may be associated with about $200 million to $400 million less gross revenues in the non-CDQ BSAI fisheries, about $20 million to $40 million less in the CDQ fisheries, and about $40 million to $100 million less in the GOA.

Alternative 5 would be very disruptive to persons and firms directly involved in fishing, processing, transportation, and other operations that service these sectors; to persons, firms, and communities dependent on the health of these sectors; and to the consumers of fish products. This would be inconsistent with the portion of the guidelines for National Standard 1 that defines "optimum yield" as "the amount of fish that would provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities…" (50 CFR 600.310).

Environmental justice impacts

Chapter 13 analyzes the impacts of the alternatives related to environmental justice issues. This analysis determines whether minority populations or low-income populations are present in the areas affected by the alternatives, and if so, whether the implementation of the alternatives may cause disproportionately high and adverse human health or environmental impacts on those populations. Minority populations and low-income populations subject to potential environmental justice concerns are found in both the GOA and the BSAI, the CDQ region, and in the context of subsistence issues.

Under the status quo harvest strategy, fishery ABCs, and consequently fishery TACs are expected to decrease in 2007 and 2008 from 2006 levels. Revenue declines will be proportionately larger for CDQ groups, because pollock declines are expected to be substantial, and CDQ groups depend heavily on pollock. Competition for prey between Steller sea lion, and northern fur seals and fisheries, and salmon bycatch, are not well understood and create potential environmental justice concerns. Alternative 1 impacts are the same as Alternative 2 impacts in the BSAI. Alternative 1 may provide more revenue than Alternative 2 in the GOA, but the impact is likely to be relatively small. Adverse impacts to minority and low-income populations in western Alaska would likely occur under Alternatives 3, 4, or 5 through impacts to CDQ program revenues and associated employment opportunities. Lower impacts to subsistence resources are likely under Alternatives 3 and 4 due to less likelihood of incidental take of salmon and marine mammals and less potential competition for prey species in the BSAI compared to Alternatives 1 and 2. Any potential impacts of Alternatives 1 and 2 on subsistence resources may result in disproportionate impacts to minority or low-income populations in the BSAI.

Areas of controversy and issues yet to be resolved

Management of the groundfish fisheries has long been and will remain a highly controversial subject. Chapter 1 identifies the issues with setting harvest specifications raised by the public. Many of the issues raised highlight areas of on-going controversy which, though greatly informed by analyses such as this one, are not totally resolved. Differences of opinion exist among various industry, environmental, management, and scientific groups on the appropriate harvest levels for various target species. Areas of controversy primarily focus on the effects of groundfish harvests on the ten major issues analyzed in this EIS. The most controversial of these are the effects groundfish harvest has on target groundfish species, marine mammals, and Alaskan communities.

Management decisions for all groundfish species are intended to minimize impacts from an ecosystem perspective, however, the harvest strategies remain controversial for many reasons. Harvest strategies are primarily based on single species stock assessments and TACs rather than using multispecies or ecosystem models. Some commenters express concerned that setting and managing the TACs for individual species does not adequately account for the impacts harvest of that species may have on other components of the ecosystem. Others believe that the setting of TACs for individual species is done in a sufficiently conservative manner so that other components of the ecosystem are protected.

For long lived species (e.g. rockfish), some believe that the status quo harvest strategy is too aggressive for the sustainability of the population while others believe that the harvest strategy is very conservative. See Chapter 4 for a detailed discussion on groundfish management, including a section focused on rockfish management.

The EIS for the Steller sea lion protection measures identified the controversy regarding the effects of fishing on Steller sea lions (NMFS 2001; reference in Chapter 1). The harvest specifications include limits on and seasonal apportionments of harvest of pollock, Atka mackerel, and Pacific cod, which are important Steller sea lion prey species. Some argue that fisheries compete with Steller sea lions for prey, and that this competition reduces the survival of Steller sea lions resulting in continued decline. Others argue that the fishing industry is not responsible for the decline of Steller sea lions, but rather other factors (e.g., climate change, predation by killer whales) are to blame. Even with the large increase in research activities, conclusive proof of fisheries effects on nutritional health of Steller sea lions has not been found. The lack of unequivocal evidence regarding fisheries impacts on Steller sea lion nutritional health combined with the Endangered Species Act requirement to ensure the fisheries are not likely to cause jeopardy of extinction or adverse modification of critical habitat frustrates participants in fisheries that believe they are not impacting Steller sea lions.

The EIS for annual subsistence harvest of northern fur seals identifies the controversy regarding the effects of fishing on the availability of fur seal prey (NMFS 2005; reference in Chapter 8). Some are concerned with the potential impact of fisheries on the nutritional health of fur seals, though information on potential competition between fur seals and the fisheries also is limited. Further discussions on Steller sea lions and fur seals and fisheries impacts are in Chapter 8.

Alaskan coastal communities depend on the marine resources for their livelihoods and lifestyles, whether as participants in commercial fisheries, tourism-related businesses, subsistence or personal use. Public comment expressed concern that the status quo levels of groundfish harvest negatively impact the people and communities that rely on marine resources. Chapters 12 and 13 discuss the impacts of the alternatives on Alaskan communities.

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List of Abbreviations

ABC	Acceptable Biological Catch
ACMP	Alaska Coastal Zone Management Program
ADCED	Alaska Department of Community and Economic Development
ADF&G	Alaska Department of Fish and Game
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
AI	Aleutian Islands
AKFIN	Alaska Fisheries Information Network
AP	Advisory Panel
APA	Administrative Procedure Act
AYK	Alaska-Yukon-Kuskokwim
B	Biomass
BA	Biological Assessment
BiOp	Biological Opinion
BOF	Board of Fisheries
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands
CAI	Central Aleutian Islands
CDQ	Community Development Quota
CEQ	Council of Environmental Quality
CEY	Constant Exploitation Yield
CFEC	Alaska Commercial Fisheries Entry Commission
CFR	Code of Federal Regulations
CIE	Committee of Independent Experts
COE-CW	Corps of Engineers, Alaska District, Civil Works Division
Council	North Pacific Fishery Management Council
CP	Catcher/Processor
CPUE	Catch Per Unit Effort
CSSA	Chinook Salmon Savings Area
CV	Catcher Vessel
CVOA	Catcher Vessel Operating Area
DEC	Department of Environmental Conservation
DFA	Directed Fishing Allowance
DFL	Directed Fishing Level
DOC	Department of Commerce
DPS	Distinct Population Segment
DSR	Demersal Shelf Rockfish
EA	Environmental Assessment
EAI	Eastern Aleutian Islands
EBS	Eastern Bering Sea
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFP	Exempted Fishing Permit

EIS	Environmental Impact Statement
EIT	Echo Integration Trawl
E.O.	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Fishing Mortality Rate
FIB	Fishery in Balance
FIT	Fishery Interaction Team
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRFA	Final Regulatory Flexibility Analysis
FTE	Full-Time Equivalents
GHL	Guideline Harvest Level
GOA	Gulf of Alaska
HAPC	Habitat Area of Particular Concern
ICA	Incidental Catch Amount
IFQ	Individual Fishing Quota
IPHC	International Pacific Halibut Commission
IRFA	Initial Regulatory Flexibility Analysis
IRIU	Increased Retention and Increased Utilization
ITAC	Initial Total Allowable Catch
ITS	Incidental Take Statement
JEA	Joint Enforcement Agreement
LLP	License Limitation Program
M	Natural Mortality Rate
MFMT	Maximum Fishing Mortality Threshold
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MRA	Maximum Retainable Amount
Magnuson-Stevens Act	Magnuson Stevens Fishery Conservation and Management Act
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
mt	Metric Ton
NBER	National Bureau of Economic Research
NEPA	National Environmental Policy Act
nm	Nautical Mile
NMFS	National Marine Fishery Service
NMML	National Marine Mammal Laboratory
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
OCS	Outer Continental Shelf

OFL	Overfishing Level
OLE	Office of Law Enforcement
OY	Optimum Yield
PBR	Potential Biological Removal
PDO	Pacific Decadal Oscillation
Plan Team	NPFMC Groundfish Plan Team (BSAI and GOA)
PRD	Protected Resources Division
PSC	Prohibited Species Catch
PSQ	Prohibited Species Quota
PSEIS	Programmatic Supplemental Environmental Impact Statement
PSMFC	Pacific States Marine Fisheries Council
PWS	Prince William Sound
RACE	Resource Assessment and Conservation Engineering
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation Report
SAR	Stock Assessment Report
SBREFA	Small Business Regulatory Enforcement Fairness Act
Secretary	Secretary of the Department of Commerce
SEIS	Supplemental Environmental Impact Statement
SEO	Southeast Outside
SFD	Sustainable Fisheries Division
SLP	Sea-Level Pressure
SSC	Scientific and Statistical Committee
SST	Sea Surface Temperature
State	State of Alaska
TAC	Total Allowable Catch
TMDL	Total Maximum Daily Load
USCOP	United States Commission on Ocean Policy
USFWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System
VRHS	Voluntary Rolling Hot Spot
WAI	Western Aleutian Islands
W/C/WYK	Western/Central/West Yakutat

Chapter 1 Introduction

This EIS provides decision-makers and the public with an evaluation of the environmental, social, and economic effects of alternative harvest strategies. The EIS is intended to serve as the central decision-making document for management measures developed by the National Marine Fisheries Service (NMFS) and the North Pacific Fishery Management Council (Council) to implement the provisions of the proposed action. NMFS decided to prepare an EIS in order to assist agency planning and decision-making.

The EIS examines five alternative approaches to determine annual ceilings for fish harvest specifications. These alternatives are described in detail in Chapter 2. The EIS evaluates the environmental consequences of each of these alternatives with respect to ten major issues:

- Target species and fisheries
- Non-specified fish and invertebrate species
- Forage fish species
- Prohibited species
- Marine mammals
- Seabirds
- Essential fish habitat
- Marine ecosystem
- Economic and social impacts
- Environmental justice

1.1 What is this Action?

The proposed action is the choice of a harvest strategy for the federally managed groundfish fisheries in the Gulf of Alaska (GOA) and the Bering Sea and Aleutian Islands (BSAI) management areas. The alternative harvest strategies determine annual harvest specifications in compliance with Federal regulations, the Fishery Management Plans (FMPs) for the BSAI and GOA groundfish fisheries, and the Magnuson-Stevens Act. The U.S. Secretary of Commerce (Secretary) approves the harvest specifications based on the recommendations of the Council.

The harvest strategies are applied to the best available scientific information to determine the harvest specifications, which are the annual limits on the amount of each species of fish, or of each group of species, that may be taken. Harvest specifications include the total allowable catch (TAC), their seasonal apportionments and allocations, and prohibited species catch (PSC). Groundfish harvests are controlled by the enforcement of TAC and PSC limits, apportionments of those limits among seasons and areas, and allocations of the limits among fishing sectors.

TACs set upper limits on total (retained and discarded) harvest limits for a fishing year. TACs are set for each "target species" and "other species" category defined in the FMPs or harvest specifications. TAC seasonal apportionments and allocations are specified by regulations at 50 CFR part 679. Specific TAC amounts are calculated in this EIS for each alternative harvest strategy to illustrate the implications of the harvest strategies, given the best scientific information currently available. The TAC amounts, however, are not the action analyzed in the EIS. The action being analyzed is the alternative harvest strategies, or in other words, the principles for determining the TACs.

Prohibited species include halibut, herring, salmon, steelhead, king crab, and Tanner crab. A target fishery that has caught the seasonal (or annual) PSC limit apportioned to an area, is closed in that area for the remainder of the season (or year). PSC limits are specified in the FMP or regulations. The Council apportions PSC limits among seasons and allocates PSC limits among target fisheries, following criteria in the Federal regulations.

The Council's Groundfish Plan Teams use stock assessments to calculate biomass, overfishing levels (OFL), and acceptable biological catches (ABC), for each target species or species group for specified management areas of the exclusive economic zone off Alaska. OFLs and ABCs are published with the harvest specifications, and provide the foundation for the Council and NMFS to develop the TACs. OFL and ABC amounts reflect fishery science, applied in light of the requirements of the FMPs, and are not part of this action.

The FMPs define OFL, ABC, and TAC as follows (page 12 in each FMP):

> <u>Overfishing level (OFL):</u> "…a limit reference set annually for a stock or stock complex during the assessment process…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 maximum sustainable yield (MSY) on a continuing basis. Operationally, overfishing occurs when the harvest exceeds the OFL." MSY is defined in the FMPs as "…the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions."
>
> <u>Acceptable biological catch (ABC)</u>: "…an acceptable 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."
>
> <u>Total allowable catch (TAC)</u>: "…the annual harvest limit for a stock or stock complex, derived from the ABC by considering social and economic factors."

1.2 Statutory Authority for this Action

Under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; 16 USC 1801, et seq.), the United States has exclusive fishery management authority over all marine fishery resources found within the exclusive economic zone (EEZ), which extends between 3 and 200 nautical miles from the baseline used to measure the territorial sea.

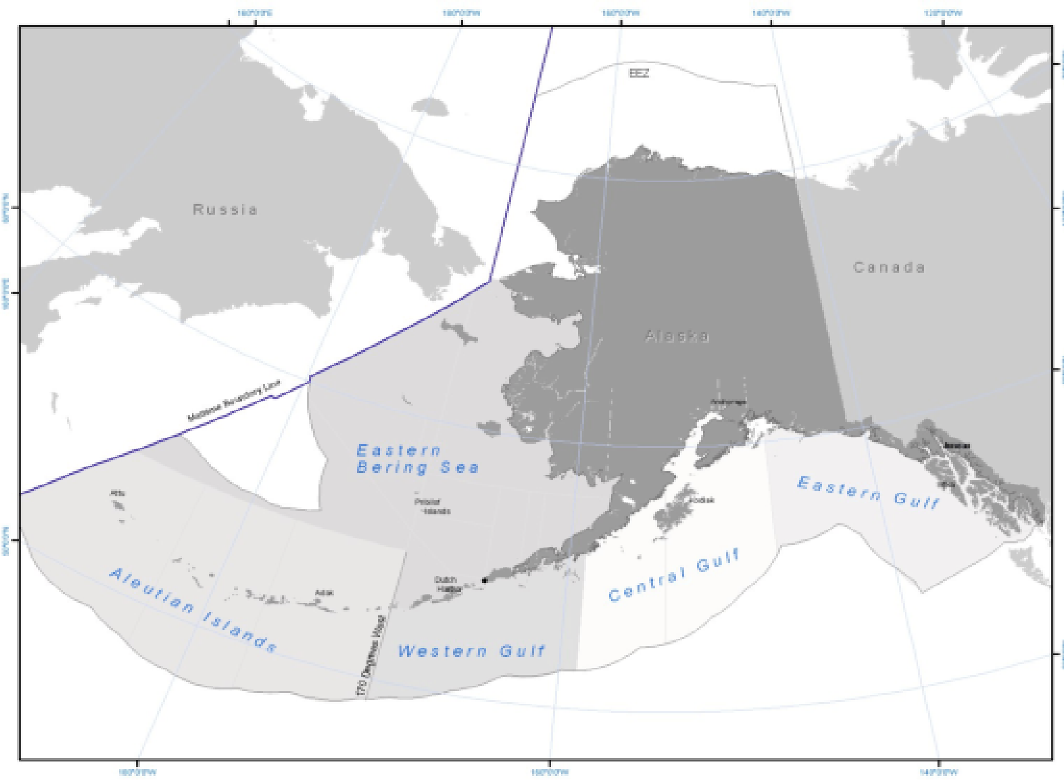
The management of these marine resources is vested in the Secretary and in the Regional Councils. In the Alaska Region, the Council has the responsibility for preparing FMPs for the marine fisheries that require conservation and management, and for submitting their recommendations to the Secretary. Upon approval by the Secretary, NMFS is charged with carrying out the Federal mandates of the Department of Commerce with regard to marine and anadromous fish.

The groundfish fisheries in the EEZ off Alaska are managed under the FMP for Groundfish of the GOA and the FMP for Groundfish of the BSAI. Actions taken to amend FMPs or implement other regulations governing these fisheries must meet the requirements of Federal laws and regulations, as discussed in Section 1.8.

1.3 The Action Area

The action area effectively covers all of the Gulf of Alaska, Bering Sea, and Aleutian Islands, under U.S. jurisdiction, extending southward to include the waters south of the Aleutian Islands west of 170°W to the border of the EEZ (Figure 1-1). The marine waters of the State of Alaska (State) have been treated as a part of the action area because vessels fishing in Federal waters pass through State waters, and because some fishing for Federal TACs takes place in State waters.

Figure 1-1 Exclusive Economic Zone (EEZ) in the waters off Alaska.



1.4 Purpose and Need for this Action

The purpose of the harvest strategy is to provide for orderly and controlled commercial fishing for groundfish (including CDQ fishing), promote sustainable incomes to the fishing, fish processing, and support industries; support sustainable fishing communities, and provide sustainable flows of fish products to consumers. The harvest strategy balances groundfish harvest in the fishing year with ecosystem needs (such as target and non-target fish stocks, marine mammals, seabirds, and habitat).

A harvest strategy is needed for the management of the groundfish fisheries and the conservation of marine resources, as required by the Magnuson-Stevens Act and as described in the management policy, goals, and objectives in the FMPs.

The harvest strategy must comply with the Magnuson-Stevens Act and other relevant laws, the groundfish FMPs, and applicable Federal regulations. The scope of this action is, therefore, constrained by the requirements of the Magnuson-Stevens Act, FMPs, and Federal regulations.

The harvest strategy must meet the Magnuson-Stevens Act's ten national standards for fisheries conservation and management. Perhaps the most influential of these is National Standard 1, which states "conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the United States fishing industry" (16 U.S.C. 1851).

The harvest strategy must comply with provisions of the groundfish FMPs. The FMPs contain management objectives to guide fishery management decision-making. These impacts to the human environment resulting from fisheries managed under these objectives were disclosed in the Alaska Groundfish Fisheries Programmatic Supplemental EIS (PSEIS) (NMFS 2004). Those objectives were embodied in the FMPs by Amendments 81 and 74, respectively (69 FR 31091, June 2, 2004, approved August 26, 2004). The FMPs also impose procedures for setting the harvest specifications. Of particular importance are the definitions of areas and stocks (Section 3.1), procedures for determination of harvest levels (Section 3.2), rules governing time and area restrictions (Section 3.5), and rules governing catch restrictions (Section 3.6).

The Federal regulations at 50 CFR part 679 provide specific constraints for the harvest specifications by establishing management measures that create the framework for the TAC apportionments and allocations. Specifically, the Federal regulations establish the general limitations, bycatch management, closures, seasons, gear limitations, and inseason adjustments.

1.5 Public Participation

This EIS was developed with opportunity for public participation and is based on and prepared from the issues and alternatives identified during the scoping process. Scoping is the term used for involving the public in the National Environmental Policy Act (NEPA) process at its initial stages. Scoping is designed to provide an opportunity for the public, agencies, and other interest groups to provide input on potential issues associated with the proposed action. Scoping is used to identify the environmental issues related to the proposed action and identify alternatives to be considered in the EIS. Scoping is accomplished through written communications and consultations with agency officials, interested members of the public and organizations, and tribal governments. Additionally, members of the public have the opportunity to comment during the Council process.

The scoping process is designed to ensure all significant issues are properly identified and fully addressed during the course of the EIS process. The main objectives of the scoping process are to (1) provide stakeholders with a basic understanding of the proposed action; (2) explain where to find additional information about the project; (3) provide a framework for the public to ask questions, raise concerns, identify issues, and recommend options other than those being considered by the agency conducting the scoping; and (4) ensure those concerns are included within the scope of the EIS.

This section describes these avenues for public participation.

1.5.1 Notice of intent and scoping

NMFS began the formal scoping period with the publication of a Notice of Intent in the *Federal Register* on March 14, 2006 (71 FR 13099). The notice described the proposed action and identified proposed alternatives and preliminary issues to be analyzed in the EIS. NMFS accepted public comments through May 15, 2006. NMFS held one public meeting in Anchorage, Alaska. Both through the Notice of Intent and at the scoping meeting, NMFS requested written comments from the public on the range of alternatives to be analyzed and on the environmental, social, and economic issues to be considered in the analysis. The scoping meeting was held in conjunction the April Council meeting. The scoping meeting was attended by a representative from an environmental organization and a community representative. NMFS also briefed the Council at its April 2006 meeting, and answered questions posed by Council members. In June, 2006, NMFS presented the Council with the Scoping Report on the results of scoping and posted the report on the NMFS Alaska Region web page at www.fakr.noaa.gov.

1.5.2 Summary of alternatives and issues identified during scoping

NMFS received nine written comments during the scoping period. Copies of the comments are contained in Appendix 1 to the Scoping Report (NMFS 2006, on the NMFS Alaska Region web page at www.fakr.noaa.gov). The comments are also available in the administrative record. Public comments identified the following alternatives that should be considered and issues that should be analyzed in this EIS.

Alternatives identified during scoping

NMFS considers all of the alternatives identified during scoping in this Draft EIS. The range of alternatives that NMFS and the Council determined best accomplish the proposed action's purpose and need are described in Chapter 2. The alternatives raised during scoping that were considered but not carried forward, and the reasons for their elimination from further detailed study, are also discussed in Chapter 2.

Generally, the comments received suggested (1) that the proposed EIS alternatives do not represent a significant departure from current groundfish management; (2) that the EIS should analyze different ecosystem-based management approaches to setting harvest limits for the North Pacific groundfish fisheries; and (3) that the TAC amounts should explicitly account for the interactions of predators and prey, spatially and temporally, with built in precautions to avoid ecosystem overfishing and large shifts in the food web.

The following summarizes the management measures suggested by public comments.

Measures to reduce TACs consistent with provisions in FMPs

- Cut all harvest by 50 percent this year and by 10 percent each succeeding year.
- Build an additional margin of safety into the fishing mortality rate rules ($F_{50\%}$ to $F_{60\%}$).
- Set a harvest rate of $F_{75\%}$ for important prey species (pollock, Atka mackerel, Pacific cod).
- Reduce the groundfish TACs for GOA trawl fleet.
- Set lower harvest rates ($F_{50\%}$ to $F_{75\%}$) for rockfish and species that are long-lived and late to mature.
- Set spatially explicit TACs for rockfish that coincide with population distributions.
- For rockfish in Tiers 4-6 set harvest rate at F=0.5M.

Measures that modify stock assessment practices to influence TACs

- Stipulate a more stringent threshold on the total allowed depression of equilibrium biomass.
- Account for ecosystem considerations in determining TACs by using frequency distributions to set ecosystem and single-species harvest levels within the normal range of natural variation.

- Minimize impacts on rockfish by modifying stock modeling to incorporate old-growth age structure.
- Consider catch of pollock in the U.S. and Russian waters as total landings and in determinations of the Eastern Bering Sea pollock TAC.
- Set TACs using a higher natural mortality rate that deducts from the ABC 50 percent of the biomass for ecosystem needs for each group of species (the Convention on the Conservation of Antarctic Living Marine Resources (CCAMLR) approach).
- Constrain TACs by ecosystem components such as northern fur seals.
- Set OY to include marine mammals getting a percent of the catch.
- Set spatially explicit ABC and OFL levels for rockfish that coincide with population distributions.

Temporal and spatial measures

- Prohibit trawling in critical habitat.
- Implement measures to spread out harvest levels throughout the year.
- Implement closures within a one-hundred-mile radius around the Pribilof Islands and a fifty-mile radius around Zhemchug Canyon.
- Use time/area closures in the GOA to prohibit fishing with trawl gear on Tanner crab fishing grounds.
- Design rockfish refugia around bycatch hotspots and important habitat.
- Establish marine protected areas based on ecological criteria.
- Disperse highly concentrated fisheries in time and space to avoid localized impacts to habitat, non-target species, and other ecosystem components.

Additional measures

- Include mitigation measures to protect communities.
- Increase observer coverage in the GOA groundfish fisheries.
- Include measures to reduce discards and waste such as kill caps on prohibited and protected species.
- Restrict gear types and phase out dirty gear such as bottom trawls.
- Reducing discards and waste by designating target species for which there is not adequate information to set the biological reference points and minimum stock size thresholds as "bycatch only" with full utilization and retention and with area and species-specific hard caps.

Issues identified during scoping

The comments received through the scoping process identified the following issues. The impacts of the proposed action and its alternatives on these issues are analyzed in Chapters 4 through 13.

1) The harvest specification process causes disproportionate impacts to Pribilof Islands and St. Lawrence Island communities and ecosystems. The EIS should evaluate the following issues:

- impacts on northern fur seals and Steller sea lions;
- variation in natural mortality due to changes in species interactions or environmental changes may limit the ability of the current harvest specification process to avoid impacting predators that compete with the fisheries for prey resources;
- spatial distribution of predator species, energy flows through the food web, and places where higher than average concentrations of birds and mammals occur;
- impacts on the economies and culture of the Pribilof Island communities; and

- impacts on subsistence use of marine mammals.

2) NOAA has failed to manage for bycatch reduction of Tanner crab in GOA groundfish fisheries. The EIS should analyze the following issues:

- effects of bottom trawl gear on Tanner crab stocks off Kodiak Island;
- effects of GOA rationalization on Tanner crab bycatch reduction and mitigation; and
- effects of Tanner crab bycatch in the groundfish fisheries on the Tanner crab fleet and communities.

3) The EIS should consider the direct, indirect, combined, and cumulative localized and regional effects of removing species and biomass on the ecosystem, target and non-target fish species, seabirds, marine mammals, and habitats. The EIS should analyze the following issues:

- effects of single-species MSY-based harvest levels on the marine ecosystem;
- effects of the groundfish fisheries on localized depletion and age-structure of rockfish;
- effects of bottom trawl and pelagic trawl gear on seafloor habitats, on managed species such as crab, on the removal of prey from marine mammal foraging habitat, and on nursery habitat;
- impacts of variation and uncertainty in natural mortality estimates for target species on the stock assessment process;
- effects of harvest levels on bycatch, including the bycatch of salmon in the pollock fishery; and
- spatial and temporal impacts of the individual fisheries on target species, non-target species, habitat, marine mammals, and seabirds.

4) The EIS should evaluate the impacts of fisheries on minority and low-income communities. Alaskan communities have suffered impacts socially, economically, and environmentally from past failed attempts to regulate fisheries. Communities are suffering from overfishing in distant waters that causes a decline in abundance of most species in near shore waters.

1.5.3 Public participation in the harvest specification process

Public involvement occurs at a number of stages during harvest specifications development. Public comments are welcomed and encouraged throughout the Council process.

In September of each year, the GOA and BSAI Plan Teams meet to review new information from the summer surveys and plan for the preparation of the Stock Assessment and Fishery Evaluation (SAFE) documents. These are open public meetings, and notice is provided in the *Federal Register*. The public is given opportunities to comment on the discussions of the Plan Team members. The Plan Teams make preliminary OFL and ABC recommendations at these meetings.

At the October Council meeting, the Council's Scientific and Statistical Committee (SSC) reviews the OFL and ABC recommendations and the accompanying NEPA and Regulatory Flexibility Act (RFA) analyses. The public has an opportunity to submit comments at these meetings. The Council's Advisory Panel (AP) reviews the Plan Team's recommendations, and makes preliminary recommendations about appropriate TACs to the Council. The public also has an opportunity to submit comments at this time. Finally, the Council reviews reports from the SSC and AP, and the NEPA and RFA analyses, and recommends its preferred OFL, ABC, and TAC specification alternatives. The public has an opportunity to submit comments to the Council, before the Council makes its decision.

The Secretary publishes the proposed specifications in the *Federal Register*. The public is given a minimum of 30 days to submit comments, prior to publication of the final specifications.

In November, the GOA and BSAI Plan Teams meet again to review the new and updated SAFE documents that have been prepared by the NMFS Alaska Fisheries Science Center (AFSC) scientists. As in September, these are open public meetings, with notice provided in the *Federal Register*. The public is given opportunities to comment on the discussions of the Plan Team members. The Plan Teams may revise their OFL and ABC recommendations at this time, if new information justifies this.

At the December Council meeting, the Council's SSC and AP review the SAFE analyses, the Plan Team OFL and ABC recommendations, and the accompanying NEPA and RFA analyses. The SSC will make OFL and ABC recommendations, and the AP will add TAC recommendations. The public has an opportunity to submit comments at these meetings. As in October, the Council reviews the reports from the SSC and AP, and the NEPA and RFA analyses, and recommends its preferred OFL, ABC, and TAC specification alternative to the Secretary. The public has an opportunity to submit comments to the Council, before it makes its decision.

In late December and January, following the December Council meeting, the harvest specifications rule and the accompanying analyses are revised. Comments on information released prior to and during the December Council meeting may still be coming in. Those comments are given consideration in final edits of the analyses. Usually in late February or early March, the Secretary will publish final specifications for the current and next years. These are published 30 days before they are to become effective, unless good cause is found to waive this "cooling off" period, in which case the specifications become effective on the date of publication in the *Federal Register.*

1.6 Cooperating Agencies and Tribal Governments

The Council for Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA emphasize agency cooperation early in the NEPA process. NMFS is the lead agency for this EIS and there are no cooperating agencies. NMFS notified representatives of the U.S Coast Guard, Alaska Department of Fish and Game, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, the U.S. State Department, and the U.S. Fish and Wildlife Service (USFWS), of its intent to prepare an EIS when it briefed the Council at its April 2006 and June 2006 meetings.

NMFS has special obligations to consult and coordinate with tribal governments on a government-to-government basis pursuant to Executive Order 13175 and the Executive Memorandum of April 29, 1994, on "Government-to-Government Relations with Native American Tribal Governments." On April 10, 2006, NMFS mailed a letter to 114 Alaska tribal governments, providing information about the EIS and soliciting consultation and coordination with interested tribal governments. To date, no requests for meetings have been received from any of the tribal governments. NMFS received two comments from tribal government representatives, which are summarized above in Section 1.5.2.

1.7 Related NEPA Documents

The NEPA documents listed below have detailed information on the groundfish fisheries, and on the natural resources and the economic and social activities and communities affected by those fisheries. These documents contain valuable background for the action under consideration in this EIS.

Alaska Groundfish Programmatic Supplemental EIS

The implementation of the harvest specifications is a project-level action within the fishery management programs under the GOA and BSAI groundfish FMPs. In June 2004, NMFS completed the PSEIS that disclosed the impacts from alternative groundfish fishery management programs on the human environment (NMFS 2004). The following provides information on the relationship between this EIS and the PSEIS. NMFS issued a Record of Decision on August 26, 2004, with the simultaneous approval of Amendments 74 and 81 to the FMPs, respectively. This decision implemented a policy for the groundfish fisheries management programs that is ecosystem-based and is more precautionary when faced with scientific uncertainty. For more information on the PSEIS, see the Alaska Region website at: http://www.fakr.noaa.gov/sustainablefisheries/seis/default.htm.

The PSEIS brings the decision-maker and the public up to date on the current state of the human environment, while describing the potential environmental, social, and economic consequences of alternative policy approaches and their corresponding management regimes for management of the groundfish fisheries off Alaska. In doing so, it serves as the overarching analytical framework that will be used to define future management policy with a range of potential management actions. Future amendments and actions will logically derive from the chosen policy direction set for the PSEIS' preferred alternative.

As stated in the PSEIS, any specific FMP amendments or regulatory actions proposed in the future will be evaluated by subsequent environmental assessments (EAs) or EISs that incorporate by reference information from the PSEIS but stand as case-specific NEPA documents and offer more detailed analyses of the specific proposed actions. As a comprehensive foundation for management of the GOA and BSAI groundfish fisheries, the PSEIS functions as a baseline analysis for evaluating subsequent management actions and for incorporation by reference into subsequent EAs and EISs that focus on specific Federal actions.

The CEQ regulations encourage agencies preparing NEPA documents to incorporate by reference the general discussion from a programmatic EIS and concentrate solely on the issues specific to the EIS subsequently prepared. According to the CEQ regulations, whenever a programmatic EIS has been prepared and a subsequent EIS is then prepared on an action included within the entire program or policy, the subsequent EIS shall concentrate on the issues specific to the subsequent action. The subsequent EIS need only summarize the issues discussed and incorporate discussions in the programmatic EIS by reference (see 40 CFR 1502.20).

The Alaska Groundfish Harvest Specifications EIS will offer a detailed analysis of the proposed action, the harvest specifications. The harvest specification alternatives derive from the policy established in the preferred alternative in the PSEIS. This EIS incorporates by reference information from the PSEIS, when applicable, to focus the analysis on the issues ripe for decision and eliminate repetitive discussions.

Annual TAC-Specification Environmental Assessments

In addition to the PSEIS, EAs have been written to accompany annual harvest specifications since 1991. The 2005 and 2006 harvest specifications were analyzed in an EA and a finding of no significant impact was made prior to publication of the specifications. Harvest specification EAs back to 2000 may be found at the NMFS AKR web site at: http://www.fakr.noaa.gov/index/analyses/analyses.asp#top.

TAC-Specification Supplemental Environmental Impact Statement

In 1998, NMFS prepared an SEIS for the Groundfish Total Allowable Catch Specifications and Prohibited Species Catch Limits Under the Authority of the Fishery Management Plans for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area and Groundfish of the Gulf of Alaska (NMFS 1998). The purpose of the SEIS was to provide an evaluation of the impacts of the groundfish fisheries through an analysis of alternative TAC levels and provide an up-dated baseline of environmental and economic information to use in assessing future regulatory actions. The SEIS was challenged under NEPA in Federal Court and remanded to the agency for inadequacies in scope and failure of the agency to prepare timely FMP level supplemental EISs. The PSEIS, discussed above, was then prepared in response to the court order. The scope of the analysis in the PSEIS was expanded to include all actions and harvest management activities in the two FMPs.

Essential Fish Habitat EIS

In 2005, NMFS and the Council completed the EIS for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS, NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to Section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: (1) describing and identifying EFH for Council managed fisheries, (2) adopting an approach to identify Habitat Areas of Particular Concern within EFH, and (3) minimizing to the extent practicable the adverse effects of fishing on EFH. The Council's preferred alternatives from the EFH EIS are implemented through Amendments 78/65 and 73/65 to the GOA and BSAI FMPs, respectively, and corresponding amendments to the Council's other FMPs. A Record of Decision was issued on August 8, 2005. NMFS approved the amendments on May 3, 2006. Regulations implementing the EFH/HAPC protection measures were effective July 28, 2006 (71 FR 36694, June 28, 2006). The Final EIS may be found on the NMFS AKR web site at: http://www.fakr.noaa.gov/habitat/seis/efheis.htm.

Several management analytical tools and measures are contained in appendices to the EFH EIS.

Appendix B - Evaluation of Fishing Activities that May Adversely Affect EFH. Appendix B addresses the requirement to conserve and protect fish habitats from adverse fishing activities. Appendix B includes a newly developed model completed by NMFS and reviewed by a panel of independent scientists. The model evaluates current fishing activities on areas specifically described as EFH, incorporates the most accurate and up-to-date fishing gear descriptions, and formulates an effects index. Index values provide a range of fishing gear effects on habitat.

Appendix F – Essential Fish Habitat Assessment Reports (HAR). Appendix F is the most recent compilation of habitat related information for each fishery stock by FMP. The HAR contains life history, reproductive traits, and predator/prey relationship information. Additionally, each species profile in the HAR contains a list of references and information sources used by stock assessment experts for that species.

EFH EIS, Section 3.4.1 Magnuson-Stevens Act Managed Fisheries. For each of the five FMPs (GOA Groundfish, BSAI Groundfish, BSAI Crab, Scallops, and Salmon), a subsection accurately describes the fisheries and gears used within that particular fishery. These descriptions are a product of a workshop held between fisheries managers and fishers regarding specific gear types currently used. This information was used in the fishing effects model to assess gear impacts on different habitat types.

Steller Sea Lion Protection Measures Supplemental EIS

A supplemental EIS (SEIS) was completed in 2001 to evaluate the impacts of groundfish fishery management measures in the GOA and BSAI on Steller sea lions (NMFS 2001). The purpose of the SEIS was to provide information on potential environmental impacts from implementing a suite of fisheries management measures to protect the western population of Steller sea lions. Fisheries management measures were designed to not jeopardize the existence of the western population of Steller sea lions nor adversely modify their critical habitat. Alternative 4, the area and fishery-specific approach, was selected in the Record of Decision. Revision of fishery management measures in accordance with that decision has been promulgated through proposed and final rulemakings in accordance with Magnuson-Stevens Act procedures (68 FR 204, January 2 2003). Many components of the harvest specifications incorporate these management measures. The EIS may be found at the NMFS AKR web site at: http://www.fakr.noaa.gov/sustainablefisheries/seis/sslpm/default.htm.

American Fisheries Act Amendments 61/61/13/8 EIS

The American Fisheries Act (AFA) EIS was prepared to evaluate sweeping changes to the conservation and management program for the pollock fishery of the BSAI and to a lesser extent, the management programs for the other groundfish fisheries of the GOA and BSAI, the king and Tanner crab fisheries of the BSAI, and the scallop fishery off Alaska (NMFS 2002). Under the Magnuson-Stevens Act, the Council prepared Amendments 61/61/13/8 to implement the provisions of the AFA in the groundfish, crab, and scallop fisheries. Amendments 61/61/13/8 incorporated the relevant provisions of the AFA into the FMPs and established a comprehensive management program to implement the AFA. The EIS analysis evaluated the environmental and economic effects of the management program that was implemented under these amendments, and developed scenarios of alternative management programs for comparative use. The harvest specifications include components of the AFA program. The EIS may be found at the NMFS AKR web site at: http://www.fakr.noaa.gov/sustainablefisheries/afa/final_eis/cover.pdf.

1.8 Relationship of this Action to Federal Law

While NEPA is the primary law directing the preparation of this document, a variety of other Federal laws and policies require environmental, economic, and socioeconomic analysis of proposed Federal actions. This section addresses the CEQ regulations, at 1502.2(d), that require EISs to state how alternatives considered in it and decisions based on it will or will not achieve the requirements of sections 101 and 102(1) of the Act and other environmental laws and policies. This EIS contains the required analysis of the proposed Federal action to ensure that the action complies with these additional Federal laws and executive orders:

- National Environmental Policy Act (NEPA)
- Magnuson-Stevens Act (including Sustainable Fisheries Act of 1996)
- Endangered Species Act (ESA)
- Marine Mammal Protection Act (MMPA)
- Administrative Procedure Act (APA)
- Regulatory Flexibility Act (RFA)
- Information Quality Act (IQA)
- Coastal Zone Management Act (CZMA)
- Executive Order 13175: Consultation and Coordination with Indian Tribal Governments
- Executive Order 12898: Environmental Justice

- American Fisheries Act (AFA)

The following provides details on the laws and executive orders directing this analysis.

National Environmental Policy Act

NEPA (42 U.S.C. 4331, *et seq*.) establishes our national environmental policy, provides an interdisciplinary framework for environmental planning by Federal agencies, and contains action-forcing procedures to ensure that Federal decision-makers take environmental factors into account. NEPA does not require that the most environmentally desirable alternative be chosen, but does require that the environmental effects of all the alternatives be analyzed equally for the benefit of decision-makers and the public.

NEPA has two principal purposes:

> 1. To require Federal agencies to evaluate the potential environmental effects of any major planned Federal action to ensure that public officials make well-informed decisions about the potential impacts.
>
> 2. To promote public awareness of potential impacts at the earliest planning stages of major Federal actions by requiring Federal agencies to prepare a detailed environmental evaluation for any major Federal action significantly affecting the quality of the human environment.

NEPA requires an assessment of both the biological and the social and economic consequences of fisheries management alternatives and provides that members of the public have an opportunity to be involved in and to influence decision-making on Federal actions. In short, NEPA ensures that environmental information is available to government officials and the public before decisions are made and actions taken.

Title II, Section 202 of NEPA (42 U.S.C. 4332) created the Council of Environmental Quality (CEQ). The duties of the CEQ include, among other things, advising and assisting the President in preparing an annual environmental quality report, which is submitted to Congress. This report gathers information concerning trends in the quality of the environment, and developing policies to promote the goals of NEPA (42 U.S.C. 4344). The CEQ is also responsible for the development and oversight of regulations and procedures implementing NEPA. The CEQ regulations provide guidance for Federal agencies regarding NEPA's requirements (40 CFR Part 1500) and require agencies to identify processes for issue scoping, for the consideration of alternatives, for developing evaluation procedures, for involving the public and reviewing public input, and for coordinating with other agencies—all of which are applicable to the Council's development of FMPs.

NOAA has also prepared environmental review procedures for implementing NEPA (NOAA Administrative Order 216-6). This Administrative Order describes NOAA's policies, requirements, and procedures for complying with NEPA and the implementing regulations issued by the CEQ. A 1999 revision and update to the Administrative Order includes specific guidance regarding categorical exclusions, especially as they relate to endangered species, marine mammals, fisheries, and habitat restoration. The Administrative Order also expands on guidance for consideration of cumulative impacts and "tiering" in the environmental review of NOAA actions. This Administrative Order provides comprehensive and specific procedural guidance to NMFS and the Council for preparing and adopting FMPs.

Federal fishery management actions subject to NEPA requirements include the approval of FMPs, FMP amendments, and regulations implementing FMPs. Such approval requires preparation of the appropriate level of NEPA analysis (Categorical Exclusion, Environmental Assessment, or Environmental Impact Assessment).

NEPA and the Magnuson-Stevens Act requirements for schedule, format, and public participation are compatible and allow one process to fulfill both obligations. The purpose of an EIS is to predict and disclose the impacts of the proposed action and its alternatives on the human environment.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Act of 1976 (16 U.S.C. 1801, *et seq*.) authorized the U.S. to manage its fishery resources in an area extending from a State's territorial sea (extending in general and in Alaska to 3 nm from shore) to 200 nm (4.8 km to 320 km) off its coast (termed the EEZ). The management of these marine resources is vested in the Secretary and in regional Fishery Management Councils. In the Alaska Region, the Council is responsible for preparing FMPs for marine fishery resources requiring conservation and management. NMFS is charged with carrying out the Federal mandates with regard to marine fish. The NMFS Alaska Regional Office and AFSC research, draft, and review the management actions recommended by the Council.

The Magnuson-Stevens Act established the required and discretionary provisions of an FMP and created ten National Standards to ensure that any FMP or FMP amendment is consistent with the Magnuson-Stevens Act. Each FMP contains a suite of additional management tools that together characterize the fishery management regime. These management tools are either a framework type measure, thereby allowing for annual or periodic adjustment using a streamlined notice process, or are conventional measures that are fixed in the FMP and its implementing regulations and require a formal plan or regulatory amendment to change.

The Sustainable Fisheries Act of 1996 (SFA; Public Law 104-297) reauthorized and made significant amendments to the Magnuson-Stevens Act. While the original focus of the Magnuson-Stevens Act was to Americanize the fisheries off the coasts of the U.S., the SFA included provisions aimed at the development of sustainable fishing practices in order to guarantee a continued abundance of fish and continued opportunities for the U.S. fishing industry. The SFA included provisions to prevent overfishing, ensure the rebuilding of overfished stocks, minimize bycatch, identify and conserve essential fish habitat, and address impacts on fish habitat. Finally, the SFA codified the Alaskan community development quota (CDQ) program already adopted by the Council and commissioned a National Academy of Sciences study of the CDQ program.

The SFA emphasizes the need to protect fish habitat. Under the law, regional Councils prepared amendments identifying essential fish habitat (EFH) as areas necessary to manage fish species for their basic life functions. The EFH provisions of the Magnuson-Stevens Act require NMFS to provide recommendations to Federal and State agencies for conserving and enhancing EFH, for any actions that may adversely impact EFH.

The action under examination in this EIS is the proposed groundfish harvest specifications. In line with NMFS policy of blending EFH assessments into existing environmental reviews, NMFS intends the NEPA analysis contained in this EIS to double as an EFH assessment. An EFH consultation will be carried out with the NMFS Alaska Region's Habitat Division before the publication of the final harvest specifications.

Endangered Species Act

The ESA of 1973 as amended (16 U.S.C. 1531, *et seq.*), provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by NMFS and the USFWS. With some exceptions, NMFS oversees marine mammal species, marine and anadromous fish species, and marine plant species. USFWS oversees walrus, sea otter, seabird species, and terrestrial and freshwater wildlife and plant species.

The listing of a species as threatened or endangered is based on the biological health of that species. Threatened species are those likely to become endangered in the foreseeable future (16 U.S.C. § 1532(20)). Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range (16 U.S.C. § 1532(20)). Species can be listed as endangered without first being listed as threatened.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the "maximum extent prudent and determinable" (16 U.S.C. § 1533(b)(1)(A)). The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans (whales), which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Federal agencies have an affirmative mandate to conserve listed species. One assurance of this is that Federal actions, activities or authorizations (hereafter referred to as Federal action) must be in compliance with the provisions of the ESA. Section 7 of the ESA provides a mechanism for consultation by the Federal action agency with the appropriate expert agency (NMFS or USFWS). Informal consultations, resulting in letters of concurrence, are conducted for Federal actions that have no adverse affects on the listed species. The action agency can prepare a biological assessment to determine if the proposed action would adversely affect listed species or modify critical habitat. The biological assessment contains an analysis based on biological studies of the likely effects of the action on the species or habitat.

Formal consultations, resulting in biological opinions, are conducted for Federal actions that may have an adverse affect on the listed species. Through the biological opinion, a determination is made about whether the proposed action poses "jeopardy" or "no jeopardy" of extinction or adverse modification or destruction of designated critical habitat for the listed species. If the determination is that the action proposed (or ongoing) will cause jeopardy or adverse modification of critical habitat, reasonable and prudent alternatives may be suggested which, if implemented, would modify the action to no longer pose the jeopardy of extinction or adverse modification to critical habitat for the listed species. These reasonable and prudent alternatives must be incorporated into the Federal action if it is to proceed. A biological opinion with the conclusion of no jeopardy or adverse modification of critical habitat may contain reasonable and prudent measures intended to further reduce the negative impacts to the listed species. These management alternatives are advisory to the action agency (50 CFR 402.24(j)). If the likelihood exists of any taking[1] occurring during promulgation of the action, an incidental take statement may be appended to a biological opinion to provide for the amount of take that is expected to occur from normal promulgation of the action. An incidental take statement is not the equivalent of a permit to take.

[1] The term "take" under the ESA means "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct" (16 U.S.C. § 1538(a)(1)(B)).

This EIS contains an analysis of the impacts of the proposed specifications on ESA listed marine mammals and seabirds (in Chapters 8 and 9). A Section 7 ESA consultation will be carried out with the NMFS Alaska Region's Protected Resources Division and USFWS before the publication of final harvest specifications.

Marine Mammal Protection Act

The MMPA of 1972 (16 U.S.C. 1361, *et seq.*), as amended, establishes a Federal responsibility to conserve marine mammals with management responsibility for cetaceans and pinnipeds (seals other than walrus) vested with NMFS. USFWS is responsible for all other marine mammals in Alaska including sea otter, walrus, and polar bear. Congress found that certain species and population stocks of marine mammals are or may be in danger of extinction or depletion due to human activities. Congress also declared that marine mammals are resources of great international significance.

The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the ESA. The Secretary is required to give full consideration to all factors regarding regulations applicable to the "take" of marine mammals, including the conservation, development, and utilization of fishery resources, and the economic and technological feasibility of implementing the regulations. If a fishery affects a marine mammal population, the Council or NMFS may be requested to consider regulations to mitigate adverse impacts. This EIS analyzes the potential impacts of the groundfish fisheries on marine mammals in Chapter 8.

Administrative Procedure Act

The APA (5 U.S.C. 553) requires Federal agencies to give the public prior notice of rule making and an opportunity to comment on proposed rules. General notice of proposed rule making must be published in the *Federal Register*, unless persons subject to the rule have actual notice of the rule. Proposed rules published in the *Federal Register* must include reference to the legal authority under which the rule is proposed and explain the nature of the proposal including what action is proposed, why it is being proposed, its intended effect, and any relevant regulatory history that provides the public with a well-informed basis for understanding and commenting on the proposal. The APA does not specify how much time the public must be given for prior notice and opportunity to comment; however, Section 304 (b) of the Magnuson-Stevens Act provides that proposed regulations that implement an FMP or FMP amendment, or that modify existing regulations, are to have a public comment period of 15 to 60 days.

Except for the emergency or interim rule provisions, a proposed rule is designed to give interested or affected persons the opportunity to submit written data, views or arguments for or against the proposed action. After the end of a comment period, the APA requires that comments received be summarized and responded to in the final rule notice. Further, the APA requires that the effective date of a final rule is no less than 30 days after publication of the final notice in the *Federal Register*. This delayed effectiveness, or "cooling off" period, is intended to allow the affected public to become aware of, and prepared to comply with the requirements of the rule. For fishery management regulations, the primary effect of the APA, in combination with the Magnuson-Stevens Act, NEPA, and other statutes, is to provide for public participation and input into the development of FMPs, FMP amendments, and regulations implementing FMPs. Section 1.5 of this EIS describes the opportunities available for public comment during the process of adopting groundfish harvest specifications.

Regulatory Flexibility Act

The RFA of 1980 (5 U.S.C. 601, *et* seq.), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996, requires Federal agencies to consider the impact of their regulatory proposals on directly regulated small entities, analyze alternatives that minimize small entity impacts, and make their analyses available for public comment. The RFA applies to a wide range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions. The SBA has established size criteria for all major industry sectors in the United States, including fish harvesting and fish processing businesses.

The RFA applies to any regulatory actions for which prior notice and comment is required under the APA. After an agency begins regulatory development and determines that the RFA applies, it must decide whether to conduct a full regulatory flexibility analysis or to certify that the proposed rule will not "have a significant economic impact on a substantial number of small entities."

Unless an agency can certify that an action will not have a significant impact on a substantial number of small entities, the agency must prepare an initial regulatory flexibility analysis (IRFA) for actions subject to the RFA to accompany a proposed rule, and a final regulatory flexibility analysis (FRFA) to accompany the final rule. NMFS has published revised guidelines, dated August 16, 2000, for RFA analyses; they include criteria for determining if the action would have a significant impact on a substantial number of small entities. The NMFS guidelines can be found at http://www.nmfs.noaa.gov/sfa/prorules.html.

NMFS will prepare an IRFA for the proposed harvest specifications and an FRFA for the final harvest specifications to evaluate the adverse impacts of this action on directly regulated small entities, in compliance with the RFA.

Information Quality Act

Information Quality Act (Section 515 of Public Law 106-554) directed the Office of Management and Budget (OMB) to issue government-wide policy and procedural guidance for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies. The OMB's guidelines require all Federal agencies to develop their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by the agency. NOAA published its guidelines in September 2002 (available online at http://www.noaanews.noaa.gov/stories/iq.htm). Pursuant to Section 515 of Public Law 106-554, this information product has undergone a pre-dissemination review by Sustainable Fisheries, completed on August 10, 2006.

Coastal Zone Management Act

The CZMA (16 U.S.C. 1451, *et seq.*) is designed to encourage and assist states in developing coastal management programs, to coordinate State activities, and to safeguard regional and national interests in the coastal zone. Section 307(C) (16 U.S.C. 1456(c)) of the CZMA requires that any Federal activity affecting the land or water or uses natural resources of a state's coastal zone be consistent with the state's approved coastal management program, to the maximum extent practicable.

A proposed fishery management action that requires an FMP amendment or implementing regulations must be assessed to determine whether it directly affects the coastal zone of a state with an approved coastal zone management program. If so, NMFS must provide the state agency having Coastal Zone Management responsibility with a consistency determination for review at least 90 days before final action of NMFS. Prior to implementation of the harvest specifications, NMFS will determine whether this action is consistent to the maximum extent practicable with the enforceable policies of the approved coastal management program of the State of Alaska and submit this determination for review by the responsible state agency.

Executive Order 13175: Consultation and coordination with Indian tribal governments

Executive Order 13175 on consultation and coordination with Indian tribal governments was signed by the President on November 6, 2000 (65 FR 67249, November 9, 2000) and supersedes the previous E.O. 13084. The purpose of this E.O. is to establish regular and meaningful consultation and collaboration with Indian tribal governments in the development of Federal regulatory practices that significantly or uniquely affect their communities; to reduce the imposition on unfunded mandates on Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments. This E.O. requires Federal agencies to have an effective process to involve and consult with representatives of Indian tribal governments in developing regulatory policies and prohibits regulations that impose substantial direct compliance costs on Indian tribal communities. In conjunction with the preparation of this EIS, NMFS has initiated a government-to-government consultation process with affected tribal governments, as described in Section 1.6.

Executive Order 12898: Environmental Justice

Executive Order 12898, signed by the President on February 11, 1994, and published February 16, 1994 (59 FR 7629) requires that Federal agencies make achieving environmental justice part of their mission by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low income populations in the U.S. A growing number of Alaska natives participate in the groundfish fisheries as a result of the Federal CDQ program and, as a result, coastal native communities participating in the CDQ program derive substantial economic benefits from the fisheries. The effects of this Federal action on minority populations are described in Chapter 13.

American Fisheries Act

The AFA of 1998 (Public Law 105-277, division C, title II) established a cooperative management program for the pollock fisheries of the BSAI. The purpose of the AFA was to tighten U.S. vessel ownership standards and to provide the BSAI pollock fleet the opportunity to conduct its fishery in a more rational manner while protecting non-AFA participants in the other fisheries. Since the passage of the AFA, the Council has taken an active role in the development of management measures to implement the various provisions of the AFA. NMFS published the final rule implementing the AFA on December 30, 2002 (67 FR 79692).

1.9 References

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1.10 Preparers and Persons Consulted

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Chapter 2 Description of Alternatives

This EIS presents alternatives, predicts the impacts associated with proceeding under those alternatives, and presents the environmental impacts of the alternatives in comparative form. Thus, this EIS sharply defines the issues and provides a clear basis for choice among options by the decisionmaker and the public. Each alternative represents a harvest strategy for determining amounts of TAC that could be set for managed species and species groups each fishing year. These alternative strategies have been selected to represent the range of harvest specification methods that are available under the Secretarial approved FMPs.

In this analysis, specific TAC amounts are calculated for each alternative to display the probable outcomes of applying that harvest strategy, given the best scientific information currently available.

The alternatives (listed below) were selected because they accomplish the stated purpose and need of the action and include an alternative of no action, which is required by CEQ Regulations for Implementing the Procedural Provisions of the NEPA. These alternatives are similar to alternatives that have been used for analysis in the specifications' NEPA compliance documents for many years. They span a range of potential harvest levels from no fishing (Alternative 5), to fishing at the upper range of the ABC levels associated with the FMP's overfishing criteria, which are themselves based on NOAA guidance under National Standard 1 (Alternative 1).

Except for the no action alternative (Alternative 5), the alternatives analyzed in this EIS are consistent with the Magnuson-Stevens Act, the goals of the FMPs, and existing regulations. The constraints for setting harvest specifications under the FMPs are (1) setting ABCs according to FMP procedures, (2) setting TAC less than or equal to ABC for all target and other species categories, and (3) setting the sum of the TACs to be within OY range. Alternatives 1, 2, 3 and 4 would establish TACs within the OY range, and therefore, meet the constraints. Alternative 4 was developed to respond to requests received during scoping to explore the impacts of setting low harvest rates and setting low and spatially explicit TACs for rockfish species that are long-lived and late to mature. Alternative 5, setting the TAC at zero for target species, was developed to explore the no action alternative, one of the fundamental requirements of the contents of an EIS.

The five alternatives are as follows:

Alternative 1: **Set TACs to produce fishing mortality rates[2], *F*, that are equal to $maxF_{ABC}$, unless the sum of the TACs is constrained by the OY established in the FMPs**. This is equivalent to setting TACs to produce harvest levels equal to the maximum permissible ABCs, as constrained by OY. The term "$maxF_{ABC}$" refers to the maximum permissible value of F_{ABC} under Amendment 56 to the groundfish FMPs. Historically, the TAC has been set at or below the ABC, therefore, this alternative represents a likely upper limit for setting the TAC within the OY and ABC limits.

Alternative 2: **(Status Quo; Preferred): Set TACs that fall within the range of ABCs recommended by the Plan Teams and TACs recommended by the Council.** Under this scenario, *F* is set equal to a constant fraction of $maxF_{ABC}$. The recommended fractions of $maxF_{ABC}$ may vary among species or stocks, based on other considerations unique to each. This is the method for determining TACs that has been used in the past.

Alternative 3: **For species in Tiers 1, 2, and 3, set TAC to produce *F* equal to the most recent 5-year average actual *F*. For species in Tiers 4, 5, and 6, set TAC equal to the most recent 5-year average actual catch.** For stocks with a high level of scientific information, TACs would be set to produce harvest levels equal to the most recent five year average actual fishing mortality rates. For stocks with insufficient scientific information, TACs would be set equal to the most recent five year average actual catch. This alternative recognizes that for some stocks, catches may fall well below ABCs, and recent average *F* may provide a better indicator of actual *F* than F_{ABC} does.

Alternative 4: **(1) Set TACs for rockfish species in Tier 3 at $F_{75\%}$. Set TACs for rockfish species in Tier 5 at F=0.5M[3]. Set spatially explicit TACs for shortraker and rougheye rockfish in the BSAI.**
(2) Taking the rockfish TACs as calculated above, reduce all other TACs by a proportion that does not vary across species, so that the sum of all TACs, including rockfish TACs, is equal to the lower bound of the area OY (1,400,000 mt in the BSAI and 116,000 mt in the GOA).
This alternative sets conservative and spatially explicit TACs for rockfish species that are long-lived and late to mature and sets conservative harvest for the other groundfish species.

Alternative 5: **(No Action) Set TACs at zero**. This *'no action'* alternative does not reflect the status quo. This alternative is outside the scope of this action, but is necessary because the CEQ regulations require the evaluation of a no action alternative.

2.1 BSAI Alternatives

Table 2-5 in Section 2.3, was developed to predict the 2007 and 2008 OFLs, ABCs, and TACs that would result if Alternative 2, the preferred alternative, is implemented, given the best scientific information currently available. For comparison, the table also includes the 2006 OFLs, ABCs, TACs, and estimated catches.

[2] *F* stands for the fishing mortality for a stock (a ratio between fishing mortality and biomass size). Fishing mortality includes both retained and discarded catch.
[3] *M* stands for an estimate of natural mortality.

Table 2-1 shows projected 2007 BSAI TACs associated with each of the five alternative harvest strategies, and Table 2-2 shows projected TACs for 2008. These projections are based on the harvest strategies, and the best information available at this time. Full details of the methods used to estimate the appropriate TAC levels for each alternative may be found in the methodological appendix (Appendix E).

The descriptive TACs for the five alternative harvest strategies were prepared in the following general way:

- **Alternative 1:** TACs are set equal to their maxF_{ABC} levels, unless this would exceed the OY. In the BSAI, the sum of the ABCs set at maxF_{ABC} would exceed the OY. Under this alternative, therefore, TACs have been set equal to their Alternative 2 levels. Under Alternative 2, the Council has been setting TACs so that they sum to the OY.

- **Alternative 2 (status quo, preferred):** For Tier 1-3 species, TACs are calculated using the stock assessment projection models used to make the Alternative 2 projections in the November 2005 SAFEs, but updated to incorporate newer estimates of 2006 and 2007 fishing mortality. For species in other tiers, 2007 TACs adopted by the Council in December 2005 are used, and rolled over into 2008.

- **Alternative 3:** For Tier 1-3 species, TACs reflect 5-year average harvest rates applied to the 2007 and 2008 projected stock abundance. For other species, TACs are equal to 5-year average harvest amounts. The five year period is 2001-2005.

- **Alternative 4:** For rockfish species with population models, TACs are set using an F_{SPR} [4]of $F_{75\%}$. For other rockfish species, TACs are set using F=0.5M (instead of the more common, F=0.75M), where M is natural mortality. For other species, TACs are set by reducing all Alternative 2 TACs by a constant proportion, so that the sum of all TACs, including the rockfish TACs, is equal to 1,400,000 mt (the lower end of the BSAI OY range).

- **Alternative 5:** All TACs are set to zero. This alternative falls outside the scope of this action, but is necessary because CEQ regulations require consideration of a no action alternative.

Under Alternatives 1 to 4, the Pacific cod TAC has been reduced by 3 percent to account for the State of Alaska Pacific cod guideline harvest level (GHL).

[4] This is the fishing mortality rate at which the spawning biomass per recruit is at a given percent of the unfished values.

Table 2-1 2007 BSAI TACs for Alternatives 1 through 5 (in mt)

Species	Area	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Pollock	EBS	1,419,800	1,419,800	1,108,900	995,314	0
	Aleutian Islands	19,000	19,000	19,000	19,000	0
	Bogoslof District	10	10	265	7	0
Pacific cod	BSAI	144,045	144,045	136,091	100,979	0
Sablefish	BS	2,580	2,580	1,935	1,809	0
	AI	2,620	2,620	1,965	1,837	0
Yellowfin sole	BSAI	117,100	117,100	37,300	82,090	0
Greenland turbot	Total	2,630	2,630	3,700	1,844	0
	BS	1,815	1,815	2,553	1,272	0
	AI	815	815	1,147	571	0
Arrowtooth flounder	BSAI	20,000	20,000	15,800	14,020	0
Rock sole	BSAI	85,736	85,736	23,200	60,103	0
Flathead sole	BSAI	22,000	22,000	9,500	15,423	0
Alaska plaice	BSAI	15,000	15,000	10,500	10,515	0
Other flatfish	BSAI	5,000	5,000	4,608	3,505	0
Pacific ocean perch	BSAI	15,100	15,100	11,700	4,200	0
	BS	3,020	3,020	2,340	840	0
	AI total	12,080	12,080	9,360	3,360	0
	WAI	5,481	5,481	4,247	1,525	0
	CAI	3,277	3,277	2,539	911	0
	EAI	3,322	3,322	2,574	924	0
Northern rockfish	BSAI	5,000	5,000	5,000	2,240	0
Shortraker rockfish	BSAI	580	580	221	387	0
Rougheye rockfish	BSAI	224	224	253	149	0
Other rockfish	BSAI	1,400	1,400	745	931	0
	BS	810	810	431	539	0
	AI	590	590	314	392	0
Atka mackerel	AI	90,900	90,900	61,500	63,723	0
	Area 543	34,182	34,182	23,126	23,962	0
	Area 542	38,718	38,718	26,195	27,142	0
	BS/Area 541	18,000	18,000	12,178	12,618	0
Squid	BSAI	1,275	1,275	1,133	894	0
Other species	BSAI	30,000	30,000	28,636	21,031	0
Total	BSAI	2,000,000	2,000,000	1,481,952	1,400,000	0

Notes: Alternative 5 is the no action alternative; AI pollock TAC equals 19,000 mt so long as ABC is greater than 19,000 mt.; shortraker and rougheye rockfish were not broken out by species under Alternative 4 (5-year average mortality rate) because they were only treated separately for the first time in 2004.

Table 2-2 2008 BSAI TACs for Alternatives 1 through 5 (in mt)

Species	Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Pollock	EBS	1,168,700	1,168,700	1,011,600	819,227	0
	Aleutian Islands	19,000	19,000	19,000	19,000	0
	Bogoslof District	10	10	266	7	0
Pacific cod	BSAI	118,049	118,049	123,287	82,749	0
Sablefish	BS	2,233	2,233	1,886	1,565	0
	AI	2,267	2,267	1,914	1,589	0
Yellowfin sole	BSAI	106,400	106,400	36,400	74,584	0
Greenland turbot	Total	2,630	2,630	3,500	1,844	0
	BS	1,815	1,815	2,415	1,272	0
	AI	815	815	1,085	571	0
Arrowtooth flounder	BSAI	144,800	144,800	16,300	101,501	0
Rock sole	BSAI	111,600	111,600	22,500	78,229	0
Flathead sole	BSAI	52,200	52,200	9,200	36,591	0
Alaska plaice	BSAI	129,637	129,637	10,200	90,872	0
Other flatfish	BSAI	18,100	18,100	4,023	12,688	0
Pacific ocean perch	BSAI	15,100	15,100	11,800	4,300	0
	BS	3,020	3,020	2,360	860	0
	AI total	12,080	12,080	9,440	3,440	0
	WAI	5,481	5,481	4,283	1,561	0
	CAI	3,277	3,277	2,561	933	0
	EAI	3,322	3,322	2,596	946	0
Northern rockfish	BSAI	5,000	5,000	5,000	2,240	0
Shortraker rockfish	BSAI	580	580	213	387	0
Rougheye rockfish	BSAI	224	224	197	149	0
Other rockfish	BSAI	1,400	1,400	713	931	0
	BS	810	810	413	539	0
	AI	590	590	300	392	0
Atka mackerel	AI	65,100	65,100	51,900	45,633	0
	Area 543	24,481	24,481	19,517	17,161	0
	Area 542	27,728	27,728	22,106	19,437	0
	BS/Area 541	12,891	12,891	10,277	9,036	0
Squid	BSAI	1,970	1,970	1,080	1,381	0
Other species	BSAI	35,000	35,000	28,934	24,534	0
Total	BSAI	2,000,000	2,000,000	1,359,913	1,400,000	0

Notes: Alternative 5 is the no action alternative; AI pollock TAC equals 19,000 mt so long as AI pollock ABC is greater than or equal to 19,000 mt.; shortraker and rougheye rockfish were not broken out by species under Alt 4 (5-year average mortality rate) because they were only treated separately for the first time in 2004.

2.2 GOA Alternatives

Table 2-6 in Section 2.3, was developed to predict the 2007 and 2008 OFLs, ABCs, and TACs that would result if Alternative 2, the preferred alternative, is implemented, given the best scientific information currently available. The table also includes, for comparison, 2006 OFLs, ABCs, TACs, and estimated catches for 2006.

Table 2-3 shows projected 2007 GOA TACs associated with each of the five alternative harvest strategies, and Table 2-4 shows projected TACs for 2008. These projections are based on the harvest strategies, and the best information available at this time. Full details of the methods used to estimate the appropriate TAC levels for each alternative may be found in the methodological appendix (Appendix E).

The descriptive TACs for the five alternative harvest strategies were prepared in the following manner:

- **Alternative 1:** TACs are set equal to their maxF_{ABC} levels. For species in Tiers 1-3, estimates of these are prepared using the same models used by assessment authors to make projections for the

2005 SAFE Reports. Updated information on catch in 2006 and 2007 was incorporated into the projections. For other species, TACs were set equal to max ABC projections in November 2005 SAFE Reports.

- **Alternative 2: (status quo; preferred)** For Tier 1-3 species, TACs are calculated using the stock assessment projection models used to make the Alternative 2 projections in the November 2005 SAFE Reports, but updated to incorporate newer estimates of 2006 and 2007 fishing mortality. For species in other tiers, 2007 TACs adopted by the Council in December 2005 are used and rolled over into 2008.

- **Alternative 3:** For Tier 1-3 species, TACs reflect 5-year average harvest rates applied to the 2007 and 2008 projected stock abundance. For other species, TACs are equal to 5-year average harvest amounts. The 5-year period is 2001-2005.

- **Alternative 4:** For rockfish species with population models, TACs are set using an F_{SPR} of $F_{75\%}$. For other rockfish species, TACs are set using F=0.5M (instead of the more common, F=0.75M), where M is natural mortality. For other species, TACs are set by reducing all Alternative 2 TACs by a constant proportion, so that the sum of all TACs, including the rockfish TACs, is equal to 116,000 mt (the lower end of the GOA OY range).

- **Alternative 5:** All TACs are set to zero. This alternative falls outside the scope of this action, but is necessary because CEQ regulations require consideration of a no action alternative.

The TAC for Pacific cod has been set approximately 25 percent below the ABC to account for a portion of the ABC harvested in fisheries in State of Alaska waters.

Since the inception of a State of Alaska managed pollock fishery in Prince William Sound (PWS), the GOA Plan Team has recommended that the GHL for the pollock fishery in PWS be deducted from the ABC for the western stock of pollock in the GOA in the Western/Central/West Yakutat (W/C/WYK) Area. For example, in 2006, the GHL for the State of Alaska PWS pollock fishery was 3.64 million pounds (1,650 mt), therefore, the Federal fishery pollock TAC was reduced by 1,650 mt.

Table 2-3 2007 GOA TACs for Alternatives 1 through 5 (in mt)

Species	Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Pollock	610	27,611	23,363	20,422	10,739	0
	620	29,114	24,635	21,534	11,324	0
	630	17,615	14,905	13,029	6,851	0
	640	1,710	1,447	1,265	665	0
	Subtotal	76,050	64,350	56,250	29,579	0
	650	6,157	6,157	0	2,830	0
	Total	82,207	70,507	56,250	32,409	0
Pacific cod (A2 Pacific cod totals are TACs, not ABCs, to account for state fisheries)	W	17,228	17,228	9,623	7,919	0
	C	24,296	24,296	13,571	11,168	0
	E	3,181	3,181	1,777	1,462	0
	Total	44,705	44,705	24,971	20,549	0
Sablefish	W	2,464	2,464	2,032	1,133	0
	C	5,879	5,879	4,849	2,702	0
	WYK	2,103	2,103	1,735	967	0
	SEO	3,254	3,254	2,684	1,496	0
	Total	13,700	13,700	11,300	6,297	0
Flatfish (deep water)	W	421	421	15	194	0
	C	4,145	4,145	625	1,905	0

Species	Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	WYK	2,665	2,665	36	1,225	0
	EYAK/SEO	1,446	1,446	4	665	0
	Total	8,677	8,677	680	3,988	0
Rex sole	W	5,545	1,298	428	597	0
	C	26,336	6,165	2,035	2,834	0
	WYK	5,015	1,174	388	540	0
	EYAK/SEO	7,104	1,663	549	764	0
	Total	44,000	10,300	3,400	4,734	0
Flatfish (shallow)	W	24,645	4,500	180	2,068	0
	C	24,336	13,000	4,967	5,976	0
	WYK	617	628	1	289	0
	EYAK/SEO	1,852	1,844	2	848	0
	Total	51,450	19,972	5,150	9,180	0
Flathead sole	W	10,909	2,000	614	919	0
	C	26,041	5,000	1,465	2,298	0
	WYK	2,072	2,091	117	961	0
	EYAK/SEO	78	57	4	26	0
	Total	39,100	9,148	2,200	4,205	0
Arrowtooth flounder	W	20,837	8,000	1,853	3,677	0
	C	139,960	25,000	12,448	11,491	0
	WYK	16,596	2,500	1,476	1,149	0
	EYAK/SEO	7,007	2,500	623	1,149	0
	Total	184,400	38,000	16,400	17,467	0
Other slope rockfish	W	577	577	143	508	0
	C	386	386	520	340	0
	WYAK	317	317	99	279	0
	EYAK/SEO	2,872	200	46	176	0
	Total	4,152	1,480	808	1,303	0
Northern rockfish	W	1,719	1,719	874	437	0
	C	4,182	4,182	2,126	1,063	0
	E	0	0	0	0	0
	Total	5,900	5,900	3,000	1,500	0
Pacific ocean perch	W	4,282	4,282	3,583	1,136	0
	C	7,646	7,646	6,398	2,029	0
	WYK	1,135	1,135	950	301	0
	SEO	1,636	1,636	1,369	434	0
	Total	14,700	14,700	12,300	3,900	0
Shortraker rockfish	W	153	153	70	102	0
	C	353	353	222	235	0
	E	337	337	205	225	0
	Total	843	843	497	562	0
Rougheye rockfish	W	124	124	55	28	0
	C	556	556	247	124	0
	E	219	219	97	49	0
	Total	900	900	400	200	0
Pelagic shelf rockfish	W	1452	1452	185	417	0
	C	3270	3270	2,270	938	0
	WYAK	302	302	382	87	0
	EYAK/SEO	437	437	10	125	0
	Total	5461	5461	2,847	1,567	0
Demersal rockfish	SEO	410	410	249	204	0
Thornyhead rockfish	W	513	513	285	342	0
	C	989	989	513	659	0
	E	707	707	236	471	0
	Total	2,209	2,209	1,034	1,472	0
Atka mackerel	GW	4,700	1,500	488	689	0
Big skate	W	695	695	26	319	0
	C	2,250	2,250	793	1,034	0
	E	599	599	61	275	0
	Total	3,544	3,544	880	1,629	0
Longnose skate	W	65	65	15	30	0
	C	1,969	1,969	959	905	0
	E	861	861	138	396	0
	Total	2,895	2,895	1,112	1,331	0

Species	Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Other skates	GW	1,617	1,617	686	743	0
Other species	Gulf wide	4,500	4,500	1,911	2,068	0
Total		520,070	260,968	146,563	116,000	0

Notes: Alternative 5 is the no action alternative. The total includes the amounts for state waters Pacific cod fisheries. Therefore the Alternative 2 total does not equal the total for TACs in Figure 2.3-2.; Other species TACs for Alternatives 1, 3, and 4 adjusted to reflect TAC < ABC using a 0.012 reduction factor.

Table 2-4 2008 GOA TACs for Alternatives 1 through 5 (in mt)

Species	Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Pollock	610	27,139	23,908	21,802	11,556	0
	620	28,616	25,209	22,989	12,185	0
	630	17,313	15,252	13,909	7,372	0
	640	1,681	1,481	1,351	716	0
	Subtotal	74,750	65,850	60,050	31,829	0
	650	6,157	6,157	0	2,976	0
	Total	80,907	72,007	60,050	34,805	0
Pacific cod (A2 Pacific cod totals are TACs, not ABCs, to account for state fisheries)	W	11,729	11,729	8,599	5,669	0
	C	16,541	16,541	12,127	581	0
	E	2,165	2,165	1,587	181	0
	Total	30,436	30,436	22,315	14,711	0
Sablefish	W	2,213	2,213	1,979	1,070	0
	C	5,278	5,278	4,720	2,551	0
	WYK	1,888	1,888	1,688	913	0
	SEO	2,921	2,921	2,612	1,412	0
	Total	12,300	12,300	11,000	5,945	0
Flatfish (deep water)	W	421	421	15	203	0
	C	4,145	4,145	617	2,004	0
	WYK	2,665	2,665	20	1,288	0
	EYAK/SEO	1,446	1,446	5	699	0
	Total	8,677	8,677	657	4,194	0
Rex sole	W	2,432	1,524	491	737	0
	C	11,552	7,242	2,334	3,500	0
	WYK	2,200	1,380	445	667	0
	EYAK/SEO	3,116	1,954	630	944	0
	Total	19,300	12,100	3,900	5,849	0
Flatfish (shallow)	W	11,592	4,500	175	2,175	0
	C	33,489	13,000	4,769	6,284	0
	WYK	1,618	628	1	304	0
	EYAK/SEO	4,750	1,844	2	891	0
	Total	51,450	19,972	4,947	9,654	0
Flathead sole	W	7,069	2,000	497	967	0
	C	17,672	5,000	1,243	2,417	0
	WYK	7,747	2,192	545	1,060	0
	EYAK/SEO	212	60	15	29	0
	Total	32,700	9,252	2,300	4,472	0
Arrowtooth flounder	W	35,853	8,000	3,516	3,867	0
	C	112,039	25,000	10,987	12,084	0
	WYK	11,204	2,500	1,099	1,208	0
	EYAK/SEO	11,204	2,500	1,099	1,208	0
	Total	170,300	38,000	16,700	18,368	0
Other slope rockfish	W	577	577	167	508	0
	C	386	386	560	340	0
	WYAK	317	317	102	279	0
	EYAK/SEO	2,872	200	29	176	0
	Total	4,152	1,480	858	1,303	0
Northern rockfish	W	1,690	1,690	903	437	0
	C	4,110	4,110	2,197	1,063	0
	E	0	0	0	0	0
	Total	5,800	5,800	3,100	1,500	0
Pacific ocean perch	W	4,312	4,341	3,642	1,195	0
	C	7,699	7,751	6,503	2,133	0
	WYK	1,142	1,150	965	316	0
	SEO	1,647	1,658	1,391	456	0
	Total	14,800	14,900	12,500	4,100	0
Shortraker rockfish	W	153	153	70	102	0
	C	353	353	222	235	0
	E	337	337	205	225	0
	Total	843	843	497	562	0

Species	Area	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Rougheye rockfish	W	124	124	55	28	0
	C	556	556	247	124	0
	E	219	219	97	49	0
	Total	900	900	400	200	0
Pelagic shelf rockfish	W	1,653	1,653	198	494	0
	C	3,751	3,751	2,237	1,120	0
	WYAK	346	346	370	103	0
	EYAK/SEO	501	501	9	150	0
	Total	6,251	6,251	2,814	1,867	0
Demersal rockfish	SEO	410	410	238	204	0
Thornyhead rockfish	W	513	513	287	342	0
	C	989	989	511	659	0
	E	707	707	175	471	0
	Total	2,209	2,209	973	1,472	0
Atka mackerel	GW	4,700	1,500	570	725	0
Big skate	W	695	695	26	336	0
	C	2,250	2,250	793	1,088	0
	E	599	599	61	290	0
	Total	3,544	3,544	880	1,713	0
Longnose skate	W	65	65	15	31	0
	C	1,969	1,969	959	952	0
	E	861	861	138	416	0
	Total	2,895	2,895	1,112	1,399	0
Other skates	GW	1,617	1,617	686	782	0
Other species	Gulf wide	14,637	4,500	1,911	2,175	0
Total		468,828	247,793	148,408	116,000	0

Notes: Alternative 5 is the no action alternative. The total includes the amounts for state waters Pacific cod fisheries. Therefore the Alternative 2 total does not equal the total for TACs in Figure 2.3-2; Other species TACs for Alternatives 1, 3, and 4 adjusted to reflect TAC < ABC using a 0.012 reduction factor.

2.3 Preferred 2007-2008 Harvest Specifications Compared to the 2006 Harvest Specifications

Tables 2-5 and 2-6 compare the 2007 and 2008 BSAI and GOA OFL, ABC, and TAC projections under Alternative 2, the preferred alternative, with the Council's recommendations for 2006 from December 2005, and with the estimated fisheries catch mortality for 2006.

Table 2-5 BSAI Alternative 2 (Preferred) OFL, ABC, and TAC recommendations for 2007-2008

Species	Area	2006				2007			2008		
		OFL	ABC	TAC	Catch**	OFL	ABC	TAC	OFL	ABC	TAC
Pollock	EBS	2,090,000	1,930,000	1,485,000	1,485,000	1,707,000	1,419,800	1,419,800	1,418,100	1,168,700	1,168,700
	Aleutian Islands	39,100	29,400	19,000	19,000	39,100	29,400	19,000	39,100	29,400	19,000
	Bogoslof District	50,600	5,500	10	0	50,600	5,500	10	50,600	5,500	10
Pacific cod	BSAI	230,000	194,000	188,180	188,180	176,100	148,500	144,045	144,900	121,700	118,049
Sablefish	BS	3,680	3,060	2,820	921	6,200	5,200	2,580	5,400	4,500	2,233
	AI	3,740	3,100	3,000	1,070			2,620			2,267
Yellowfin sole	BSAI	144,000	121,000	95,701	95,701	138,900	117,100	117,100	126,200	106,400	106,400
Greenland turbot	Total	14,200	2,740	2,740	2,487	18,300	2,630	2,630	17,500	2,630	2,630
	BS	n/a	1,890	1,890	1,890	n/a	1,815	1,815	n/a	1,815	1,815
	AI	n/a	850	850	597	n/a	815	815	n/a	815	815
Arrowtooth flounder	BSAI	166,000	136,000	13,000	13,000	172,200	140,500	20,000	177,400	144,800	144,800
Rock sole	BSAI	150,000	126,000	41,500	35,098	146,000	122,500	85,736	133,100	111,600	111,600
Flathead sole	BSAI	71,800	59,800	19,500	18,528	67,100	55,900	22,000	62,700	52,200	52,200
Alaska plaice	BSAI	237,000	188,000	8,000	17,000	227,100	180,200	15,000	218,400	173,200	129,637
Other flatfish	BSAI	24,200	18,100	3,500	3,500	24,200	18,100	5,000	24,200	18,100	18,100
Pacific ocean perch	BSAI	17,600	14,800	12,600	12,068	17,900	15,100	15,100	17,900	15,100	15,100
	BS	n/a	2,960	1,400	868	n/a	3,020	3,020	n/a	3,020	3,020
	AI total	n/a	11,840	11,200	11,200	n/a	12,080	12,080	n/a	12,080	12,080
	WAI	n/a	5,372	5,085	5,085	n/a	5,481	5,481	n/a	5,481	5,481
	CAI	n/a	3,212	3,035	3,035	n/a	3,277	3,277	n/a	3,277	3,277
	EAI	n/a	3,256	3,080	3,080	n/a	3,322	3,322	n/a	3,322	3,322
Northern rockfish	BSAI	10,100	8,530	4,500	3,887	10,100	8,500	5,000	10,000	8,500	5,000
Shortraker rockfish	BSAI	774	580	580	169	774	580	580	774	580	580
Rougheye rockfish	BSAI	299	224	224	183	299	224	224	299	224	224
Other rockfish	BSAI	1,870	1,400	1,050	556	1,870	1,400	1,400	1,870	1,400	1,400
	BS	n/a	810	460	251	n/a	810	810	n/a	810	810
	AI	n/a	590	590	305	n/a	590	590	n/a	590	590
Atka mackerel	Total	130,000	110,000	63,000	63,000	107,300	90,900	90,900	75,200	65,100	65,100
	WAI	n/a	41,360	15,500	15,500	n/a	34,182	34,182	n/a	24,481	24,481
	CAI	n/a	46,860	40,000	40,000	n/a	38,718	38,718	n/a	27,728	27,728
	EAI/BS	n/a	21,780	7,500	7,500	n/a	18,000	18,000	n/a	12,891	12,891
Squid	BSAI	2,620	1,970	1,275	1,437	2,620	1,970	1,275	2,620	1,970	1,970
Other species	BSAI	89,404	58,882	29,000	29,000	89,404	62,950	30,000	89,404	62,950	35,000
Total	BSAI	3,476,987	3,013,086	1,994,180	1,989,785	3,003,067	2,426,954	2,000,000	2,615,267	2,094,554	2,000,000

**2006 catch is based on projected catch and includes CDQ.

Table 2-6 GOA Alternative 2 (Preferred) OFL, ABC, and TAC recommendations for 2007-2008

SPECIES	AREA	2006				2007			2008		
		OFL	ABC	TAC	Catch **	OFL	ABC	TAC	OFL	ABC	TAC
Pollock	W (61)		28,918	28,918	28,918		23,363	23,363		23,908	23,908
	C (62)		30,492	30,492	30,942		24,635	24,635		25,209	25,209
	C (63)		18,448	18,448	18,488		14,905	14,905		15,252	15,252
	WYAK		1,792	1,792	1,792		1,447	1,447		1,481	1,481
	Subtotal	110,100	79,650	79,650	79,650	90,200	64,350	64,350	92,700	65,850	65,850
	EYAK/SEO	8,209	6,157	6,157	0	8,209	6,157	6,157	8,209	6,157	6,157
	Total	118,309	85,807	85,807	79,650	98,409	70,507	70,507	100,909	72,007	72,007
Pacific cod	W		26,855	20,141	26,855		22,971	17,228		15,639	11,729
	C		37,873	28,405	37,873		32,395	24,296		22,055	16,541
	E		4,131	3,718	13		3,534	3,181		2,406	2,165
	Total	95,500	68,859	52,264	64,741	70,100	58,900	44,705	48,300	40,100	30,436
Sablefish	W		2,670	2,670	2,680		2,464	2,464		2,213	2,213
	C		6,370	6,370	6,370		5,879	5,879		5,278	5,278
	WYAK		2,280	2,280	2,280		2,103	2,103		1,888	1,888
	SEO		3,520	3,520	3,520		3,254	3,254		2,921	2,921
	Total	17,880	14,840	14,840	14,840	16,500	13,700	13,700	14,800	12,300	12,300
Deep water flatfish[1]	W		420	420	13		421	421		421	421
	C		4,139	4,139	484		4,145	4,145		4,145	4,145
	WYAK		2,661	2,661	20		2,665	2,665		2,665	2,665
	EYAK/SEO		1,445	1,445	4		1,446	1,446		1,446	1,446
	Total	11,008	8,665	8,665	521	11,008	8,677	8,677	11,008	8,677	8,677
Rex sole	W		1,159	1,159	467		1,298	1,298		1,524	1,524
	C		5,506	5,506	2,301		6,165	6,165		7,242	7,242
	WYAK		1,049	1,049	0		1,174	1,174		1,380	1,380
	EYAK/SEO		1,486	1,486	0		1,663	1,663		1,954	1,954
	Total	12,000	9,200	9,200	2,769	12,000	10,300	10,300	12,100	12,100	12,100
Shallow water flatfish[2]	W		24,720	4,500	290		24,720	4,500		24,720	4,500
	C		24,258	13,000	4,433		24,258	13,000		24,258	13,000
	WYAK		628	628	0		628	628		628	628
	EYAK/SEO		1,844	1,844	3		1,844	1,844		1,844	1,844
	Total	62,418	51,450	19,972	4,726	62,418	51,450	19,972	62,418	51,450	19,972

SPECIES		2006				2007			2008		
		OFL	ABC	TAC	Catch **	OFL	ABC	TAC	OFL	ABC	TAC
Flathead sole	W		10,548	2,000	604		10,905	2,000		11,435	2,000
	C		25,195	5,000	2,174		26,047	5,000		27,313	5,000
	WYAK		2,022	2,022	0		2,091	2,091		2,192	2,192
	EYAK/SEO		55	55	0		57	57		60	60
	Total	47,003	37,820	9,077	2,778	48,600	39,100	9,148	51,100	41,000	9,252
Arrowtooth flounder	W		20,154	8,000	3,742		20,897	8,000		21,237	8,000
	C		134,906	25,000	20,584		139,879	25,000		142,155	25,000
	WYAK		15,954	2,500	41		16,542	2,500		16,811	2,500
	EYAK/SEO		6,830	2,500	35		7,081	2,500		7,197	2,500
	Total	207,678	177,844	38,000	24,402	215,300	184,400	38,000	218,800	187,400	38,000
Other slope rockfish[3]	W		577	577	577		577	577		577	577
	C		386	386	386		386	386		386	386
	WYAK		317	317	317		317	317		317	317
	EYAK/SEO		2,872	200	23		2,872	200		2,872	200
	Total	5,394	4,152	1,480	1,303	5,394	4,152	1,480	5,394	4,152	1,480
Northern rockfish[3]	W		1,483	1,483	1,483		1,719	1,719		1,690	1,690
	C		3,608	3,608	3,608		4,181	4,182		4,110	4,110
	E		0	0	0		0	0		0	0
	Total	7,673	5,091	5,091	5,091	7,000	5,900	5,900	7,000	5,800	5,800
Pacific Ocean perch	W	4,931	4,155	4,155	4,155	5,069	4,282	4,282	5,156	4,341	4,341
	C	8,806	7,418	7,418	7,418	9,052	7,646	7,646	9,208	7,751	7,751
	WYAK		1,101	1,101	1,101		1,135	1,135		1,150	1,150
	SEO		1,587	1,587	27		1,636	1,636		1,658	1,658
	E(subtotal)	3,190	2,688	2,688	1,128	3,279			3,336		
	Total	16,927	14,261	14,261	12,701	17,400	14,700	14,700	17,700	14,900	14,900
Shortraker rockfish	W		153	153	153		153	153		153	153
	C		353	353	353		353	353		353	353
	E		337	337	337		337	337		337	337
	Total	1,124	843	843	843	1,124	843	843	1,124	843	843
Rougheye rockfish	W		136	136	136		124	124		124	124
	C		608	608	608		556	556		556	556
	E		239	239	239		219	219		219	219
	Total	1,180	983	983	983	1,100	900	900	1,100	900	900

SPECIES		2006				2007			2008		
		OFL	ABC	TAC	Catch **	OFL	ABC	TAC	OFL	ABC	TAC
Pelagic shelf rockfish	W		1,438	1,438	1,438		1,452	1,452		1,653	1,653
	C		3,262	3,262	3,262		3,270	3,270		3,751	3,751
	WYAK		301	301	301		302	302		346	346
	EYAK/SEO		435	435	9		437	437		501	501
	Total	6,662	5,436	5,436	5,010	7,108	5,461	5,461	8,554	6,251	6,251
Demersal rockfish	**SEO**	650	410	410	410	650	410	410	650	410	410
Thornyhead rockfish	W		513	513	513		513	513		513	513
	C		989	989	989		989	989		989	989
	E		707	707	707		707	707		707	707
	Total	2,945	2,209	2,209	2,209	2,945	2,209	2,209	2,945	2,209	2,209
Atka mackerel	**Total**	6,200	4,700	1,500	1,500	6,200	4,700	1,500	6,200	4,700	1,500
Big skate	W		695	695	695		695	695		695	695
	C		2,250	2,250	2,250		2,250	2,250		2,250	2,250
	E		599	599	599		599	599		599	599
	Total	4,726	3,544	3,544	3,554	4,726	3,544	3,544	4,726	3,544	3,544
Longnose skate	W		65	65	65		65	65		65	65
	C		1,969	1,969	1,969		1,969	1,969		1,969	1,969
	E		861	861	861		861	861		861	861
	Total	3,860	2,895	2,895	2,895	3,860	2,895	2,895	3,860	2,895	2,895
Other skates	GW	2,156	1,617	1,617	1,617	2,156	1,617	1,617	2,156	1,617	1,617
Other species	GW	NA	NA	13,942	4,000	NA	NA	4,500	NA	NA	4,500
TOTAL		631,293	501,366	292,776							

**Catch is 2006 catch projected in April 2006, and used to calculate the 2007 OFLs and ABCs.
1/ Deep water flatfish includes Dover sole, Greenland turbot and deepsea sole.
2/ "Shallow water flatfish" includes rock sole, yellowfin sole, butter sole, starry flounder, English sole, Alaska plaice, and sand sole.
3/ The EGOA ABC of 2 mt for northern rockfish has been included in the WYAK ABC for other slope rockfish.
* Indicates rollover from previous year (no age-structured projection data available).
4/ The ABC for sablefish has been reduced by 5% in the SEO and added to the WYK to allow for 5% of the EGOA TAC to be made available for trawl incidental catch.

NOTE:
ABCs and TACs are rounded to nearest mt.
GW means Gulfwide.
Catch data source: NMFS Catch Accounting Reports.
Edited through 6-9-06

2.4 Comparison of Alternatives with 2006 TACs

Figures 2-1 and 2-2 in this section compare the 2006 TACs for certain broad aggregations of species with the descriptive TACs associated with each of the four non-zero alternative harvest strategies. Separate comparisons are made for the BSAI and the GOA, and for each of the two years for which descriptive TACs were prepared (2007 and 2008). Species have been aggregated into the following categories: pollock, Pacific cod, sablefish, flatfish, rockfish, Atka mackerel, and "other" species.

TACs are not necessarily equal to actual fishing mortality. It is possible for fishing operations to exceed a TAC. It is also common for fishing operations to harvest less than the TAC for certain species. Halibut PSC is an important limit on flatfish harvests, particularly in the GOA. It is normal for GOA flatfish fisheries to close after having caught only a small portion of the flatfish species, because halibut PSC forces the closure. For example, in the Central GOA, in 2005, the deep water flatfish fishery was closed after only taking 12 percent of the TAC, the shallow water flatfish fishery was closed after only taking 35 percent of the TAC, the flathead sole fishery was closed after only taking 38 percent of the TAC, and the rex sole fishery was closed after only taking 22 percent of the TAC (NMFS, 2005). Significant flatfish underages occur annually in this region.

In the BSAI, the alternatives would have the following predicted effects on the 2007-2008 TACs relative to the 2006 TACs:

- **Alternative 1** and **Alternative 2:** TACs under these two alternatives are identical in 2007 and 2008. In 2007, both of these alternatives are very similar to the Council's 2006 TAC recommendations. In 2008, changes are apparent. Pollock and Pacific cod TACs are smaller for both alternatives, while flatfish TACs would increase considerably to maintain harvests at the two million mt OY. Because some flatfish fisheries are constrained by halibut PSC, they may be unable to fully harvest the available TACs in 2008.

- **Alternative 3**: TACs would decrease considerably from 2006 levels. Both pollock and flatfish TACs show strong decreases.

- **Alternative 4**: Pollock and Pacific cod and rockfish TACs decrease even more than under Alternative 3. Flatfish TACs are greater than under Alternative 3.

- **Alternative 5**: Groundfish TACs would be set to zero, and there would be no groundfish harvest.

In the GOA, the alternatives would have the following predicted effects on the 2007-2008 TACs relative to the 2006 TACs:

- **Alternative 1:** TACs would be much higher than those in 2006. In recent years, GOA TACs have fallen well under the 800,000 mt upper limit of the OY range. Unlike in the BSAI, the maxF_{ABC} harvest strategy TACs in the GOA are not constrained by the OY. However, this may provide a misleading impression of the potential size of the harvest. Most of the increase in TACs comes from increased flatfish TACs. Because flatfish catches in the GOA are constrained well below the current, smaller, TACs by halibut PSC, the actual catches and levels of fishing activity associated with this alternative are likely to be very similar to those observed in 2006.

- **Alternative 2:** The TACs would be slightly lower in 2007 and 2008 than in 2006. Again, because halibut PSC is heavily constraining flatfish harvests, actual flatfish production is likely to be much lower in these years than is suggested by the amounts of TACs in the figure.

- **Alternative 3:** TACs would be smaller compared to those in 2006. The biggest difference occurs for flatfish. In this respect, the amount for Alternative 3 suggests much smaller catches compared to Alternative 2 than would actually occur.

- **Alternative 4:** Total TACs are lower than under Alternative 3. TACs for pollock, Pacific cod, and rockfish are smaller than under Alternative 3, flatfish TACs are larger.

- **Alternative 5 (not shown):** Groundfish TACs would be set to zero, and there would be no groundfish harvest.

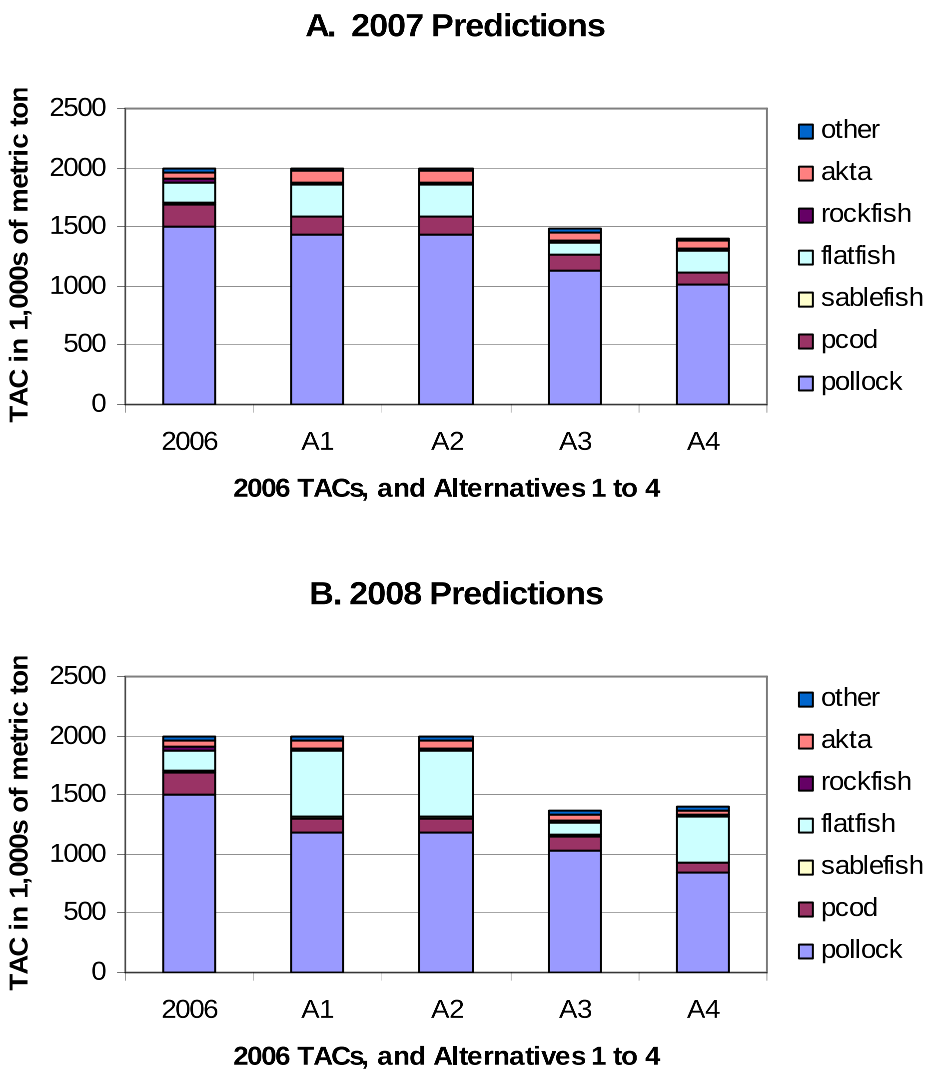

Figure 2-1 BSAI Alternatives compared to 2006 TAC levels

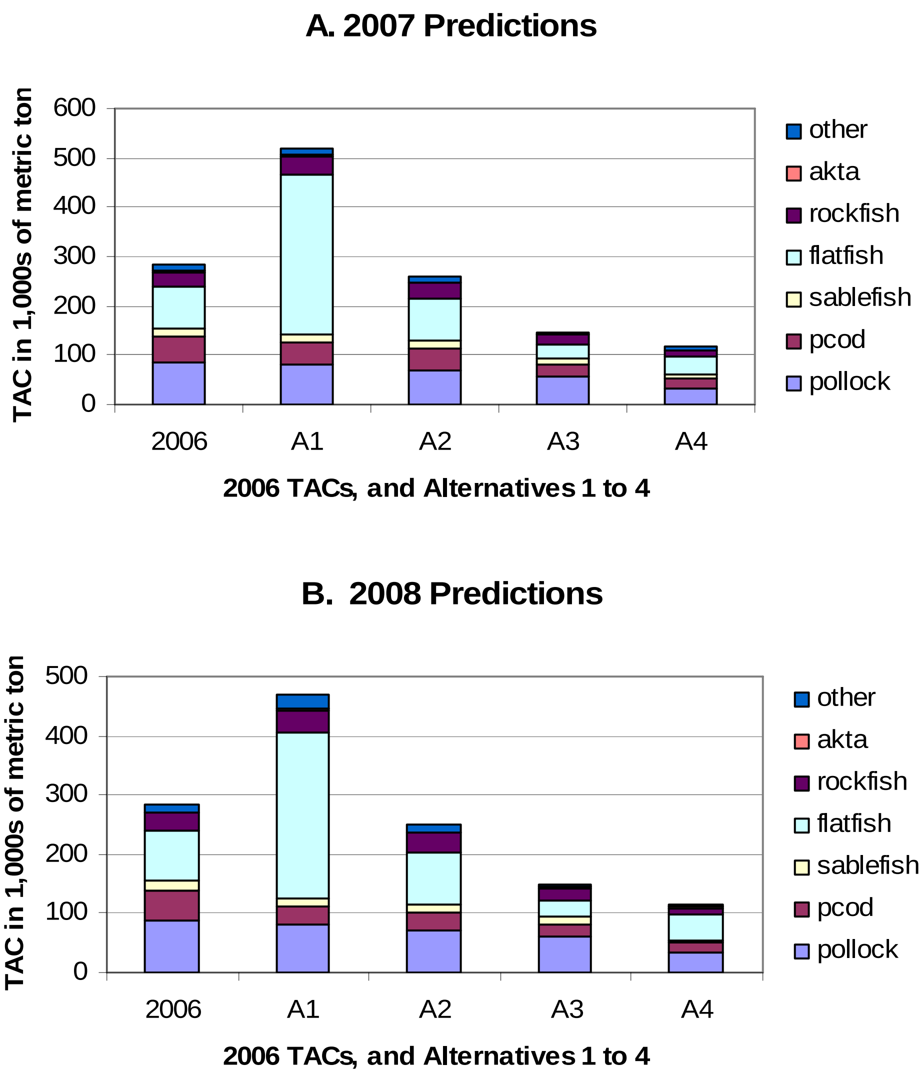

Figure 2-2 GOA Alternatives compared to 2006 TAC levels

2.5 Alternatives Considered but Eliminated from Detailed Study

During the development of the alternatives for the proposed action, NMFS considered several different measures suggested by public comments and the Council for setting the harvest specifications. This section provides a summary of the measures that did not receive detailed analysis. Each summary provides a brief explanation as to why the measure was eliminated from detailed study.

The suggested measures are grouped topically (indicated by italics below) and divided into four categories: 2.5.1 measures to reduce TACs consistent with provisions in FMPs, 2.5.2 measures that modify stock assessment practices to influence TACs, 2.5.3 temporal and spatial measures, and 2.5.4 additional measures.

2.5.1 Measures to reduce TACs consistent with provisions in FMPs

Many public comments suggested reducing the harvest rates for groundfish species. Public scoping comments are summarized, and reproduced, in the scoping report (NMFS 2006). Alternative 4 embodies the concerns raised by public comments for a more conservative alternative that reduces harvests rates of groundfish species and, in particular, long-lived rockfish species. Rockfish were selected because of public interest expressed in comments and rockfish are an important class of slow-growing long-lived species. The harvest rate reducing measures summarized below were considered but eliminated from detailed study.

Comment: Cut all harvest by 50 percent this year and by 10 percent each succeeding year.

Response: The suggestion to cut all harvest by 50 percent this year and by 10 percent each succeeding year was premised on the assertion that the groundfish stocks are overfished and that stocks are declining. This premise is not accurate based on the current groundfish stock assessments and existing status determination criteria. The total TAC amounts are constrained by the OY limit and set equal to or less than the ABCs for all groundfish species. Moreover, the proposal does not take advantage of available scientific information (including stock survey research and available population models) in formulating the management measures. Additionally, this proposal would not meet the Magnuson-Stevens Act National Standards 1, 2, and 8 because it would have severe impacts on harvesting and fish processing industries, and on persons and communities dependent on them. However, Alternative 4 substantially address this request by evaluating reductions in harvest rates.

Comment: Build an additional margin of safety into the fishing mortality rate rules ($F_{50\%}$ to $F_{60\%.}$).

Response: NMFS agrees that an alternative incorporating a more conservative approach to harvests is reasonable, and, if focused on TACs, falls within the scope of this action. Alternative 4 embodies this suggestion by setting TACs at more conservative rates that status quo.

Current TACs for many groundfish species, such as arrowtooth flounder, are at rates lower than $F_{50\%}$ to $F_{60\%}$. NMFS conducted a preliminary analysis on the TAC amounts for the groundfish based on these F rates and found that these fixed F rates may result in larger TACs for some groundfish species than status quo.

Comment: Reduce the groundfish TACs for GOA trawl fleet.

Response: Alternative 4 addresses part of this suggestion, in large part, by reducing TACs for rockfish and other groundfish species in the GOA. Groundfish harvests for GOA flatfish species are currently well below TAC levels due to the constraints associated with halibut PSC limits. Additionally, NMFS does not allocate TACs specifically to the GOA trawl fleet, except for sablefish. A separate allocation of GOA groundfish for the trawl fleet would require an FMP amendment, which is beyond the scope of this action.

The following two alternatives were considered and eliminated from detailed study for the reasons detailed below, but were not included in public comments.

Comment: For Tiers 1, 2, and 3, set TAC to produce F equal to 50 percent of maxF_{ABC}. For Tiers 4, 5, and 6, set TAC equal to 50 percent of TAC associated with maxF_{ABC}.

Response: This alternative was the "conservative alternative" in previous NEPA analyses for the harvest specifications. It was eliminated from detailed study in this EIS because it does not produce TACs within the OY range and is not justified for all groundfish species. Alternative 4 replaces this alternative as a conservative alternative.

Comment: Remove from Alternative 4 the provision to set TACs at $F_{75\%}$ for pollock, Pacific cod, and Atka mackerel (in the BSAI), unless total TAC is below OY; in which case, set an $F_{\%}$ for these species that would achieve the lower limit of OY.

Response: The Council recommended this change at its June 2006 meeting and in its June 14, 2006, letter to NMFS. NMFS believes removing this provision would result in a range of alternatives that do not effectively respond to the public comments suggesting a reduced harvest rate for groundfish species. However, NMFS agrees with the Council's comment that singling out pollock, Pacific cod and Atka mackerel as prey species is inappropriate when TACs for numerous other prey species also are established under the annual harvest specifications. After careful consideration, NMFS modified Alternative 4 to set conservative harvest rates for all groundfish species to achieve cumulative TACs at the lower end of the optimum yield ranges in the Bering Sea and Aleutian Islands and Gulf of Alaska (1.4 million metric tons and 116,000 metric tons, respectively). With this change, Alternative 4 represents a reasonable alternative for analysis in the EIS and is responsive to public concerns identified during the scoping process. These concerns focused on the effects of the groundfish harvest on marine mammals and other species important to coastal communities. Associated comments also suggested reducing TACs to account for marine mammal prey requirements and ecosystem function.

Alternative 4 will help decision makers and the public understand the comparative effects of the alternatives on marine mammals, local communities, and the ecosystem, as requested by public comments and required by NEPA.

2.5.2 Measures that modify stock assessment practices to influence TACs

These suggested management measures mandate changes in the scientific approach to stock modeling to influence TACs and as such are beyond the scope of this action. However, as the stock assessments are continually evolving based on the best scientific information and assessment methods, these suggestions have been provided to the stock assessment authors for their consideration. Alternative 4, in setting TACs at the lower end of the OY range, accomplishes many of the commenters' objectives in suggesting lowering the TACs through modifications to stock assessment practices.

Comment: The EIS should analyze different ecosystem-based management approaches to setting harvest limits for the North Pacific groundfish fisheries that explicitly account for the interactions of predators and prey, spatially and temporally, with built in precautions to avoid ecosystem overfishing and large shifts in the food web.

Response: All groundfish species are currently managed to minimize impacts from a conservation and ecosystem perspective. NMFS and the Council consider the impacts of all harvested species on the ecosystem in the development and evaluation of the SAFE report and during implementation of inseason multi-species fisheries management practices. The SAFE report evaluates the status and trends of the entire ecosystem. Also, the SAFE report responds to the stated ecosystem-based management goals of the Council. These goals are (1) maintain biodiversity consistent with natural evolutionary and ecological processes, including dynamic change and variability; (2) maintain and restore habitats essential for fish and their prey; (3) maintain system sustainability and sustainable yields for human consumption and non-extractive uses; and (4) maintain the concept that humans are components of the ecosystem.

NMFS and the Council are continuing to develop an ecosystem approach to fisheries management through policy and scientific initiatives. NMFS is developing and applying interdisciplinary approaches to studying, monitoring, and managing integrated marine systems. NMFS scientists are investigating the ecological impacts of commercial fishing and developing ecosystem models. The Council integrates ecosystem research and analysis into management decision-making through such vehicles as the programmatic review of the groundfish fisheries (PSEIS) and the annual Ecosystem Assessment and Ecosystem Considerations chapter of the SAFE report. Additionally, the Council's ecosystem committee considers policy implications of national initiatives for ecosystem management, and guides the Council in identifying opportunities to apply this work to Council management actions.

Analyzing holistic ecosystem approaches for modeling and managing harvests is beyond the scope of this action, and such approaches have already been considered in other analyses such as the PSEIS and EFH EIS. However, this EIS does evaluate the effects of alternative harvest strategies on key ecosystem components, and on the ecosystem as a whole.

Comment: Stipulate a more stringent threshold on the total allowed depression of equilibrium biomass.

Response: NMFS notes that the tier system, under the BSAI and GOA FMPs, requires that fishing rates for stocks in Tiers 1, 2, and 3, be reduced systematically as biomass levels fall below threshold levels.

The Council has modified the relationship between fishing rates and biomass levels in cases where it determined that ecosystem concerns made it necessary. For example, under the Steller sea lion harvest control rule for pollock, Atka mackerel, and Pacific cod, if a biological assessment of stock condition for pollock, Pacific cod, or Atka mackerel within an area projects that the spawning biomass in that area will be less than or equal to 20 percent of the projected unfished spawning biomass during a fishing year, the Regional Administrator will prohibit the directed fishery for the relevant species within the area. The directed fishery will remain closed until a subsequent biological assessment projects that the spawning biomass for the species in the area will exceed 20 percent of the projected unfished spawning biomass during a fishing year.

Comment: Account for ecosystem considerations in determining TACs by using frequency distributions to set ecosystem and single-species harvest levels within the normal range of natural variation.

Response: NMFS scientists have explored characterizing the natural variation of consumption rates of fish species by other species, and of ecosystem elements that are affected by fish population characteristics, with frequency distributions. These distributions could be used to guide fishery management so that catch levels would fall within these ranges (Fowler 2003). NMFS notes that the details of how this approach would work have not been worked out for the species and ecosystems of the North Pacific. For example, the range of natural variability for mortality rates from non-human sources can be quite large, and methods for selecting a fishing mortality rate to fall within this variation are required. Likewise, appropriate ecosystem elements need to be identified, decisions need to be made about which characteristics of these to use to evaluate fisheries policies, and decisions need to be made about how to relate the variation in these to changes in fishery harvests. To date, data used in analyses are from limited time frames, and therefore the natural extent of the frequency distributions are also limited. It is therefore impractical to use this approach at this time. Moreover, the logic of the method and the approach to specifications determination in the FMPs suggest that it would be most appropriate to use the technique to make determinations of ABCs, rather than of the TAC that may be caught within those ABCs. ABC determination is not a part of this action.

Comment: Minimize impacts on rockfish by modifying stock modeling to incorporate old-growth age structure.

Response: NMFS scientists already incorporate the age structure of rockfish in stock modeling. Multiple layers of precaution are built into catch levels for North Pacific rockfish with age-structured models (Tier 3). For example, GOA Pacific ocean perch are assigned an F_{ABC} at $F_{40\%}$. Bayesian spawner-recruit analysis showed that MSY was attained at approximately $F_{29\%}$. While the target fishing mortality is already well below maximum sustainable yield (MSY), part of the Eastern GOA is closed to trawling, further reducing fishing mortality by 10 percent. Another precautionary layer is to employ a catchability coefficient near two. This means that the fishing mortality is applied to a biomass estimate that is about half of the biomass estimate that is derived from the trawl survey. The age-structured modeling approach integrates a variety of information to compensate for variable survey results.

Catch levels for North Pacific rockfish with survey-biomass based models (Tier 5) are based on highly variable biomass estimates. This variability is stabilized by using a 3-survey moving average. The catch levels for these species are set by applying a fishing mortality of 75 percent of the natural mortality to the average exploitable biomass. These fishing mortalities are precautionary in that they are theoretically at least 25 percent below MSY fishing mortality and are based on very low natural mortalities (e.g., M=0.02–0.07). At this time, stock structure information has not been synthesized directly into the stock assessments because of the lack of definitive structure and sufficient data to model spatially explicit populations. However, life history characteristics are explicitly accounted for in both the fishing mortality estimates in age-structured models (Tier 3) and in survey-biomass based estimates (Tier 5). In age-structured models, age at maturity is defined specific to each species and longevity is incorporated in the natural mortality estimates and the age data. For survey biomass based models, this information is not as well known, but the low natural mortality estimates for rockfish species are based on their maximum age. Recent research of black rockfish off the West Coast shows evidence of older, mature fish being more fecund, or producing higher quality larvae, than younger mature fish. Research is in progress to attempt to answer this question for Alaskan rockfish and to explore the potential implications for fishery management. Preliminary results suggest that Pacific ocean perch F_{MSY} estimates are "relatively insensitive" to maternal effects, although they "decreased slightly" (Spencer et. al. 2005).

During the summer of 2006, the AFSC contracted with the Center for Independent Experts (CIE) at the University of Miami to conduct a review of rockfish assessments, and associated harvest strategies, in the GOA and BSAI. A committee of three independent fisheries scientists met with NMFS scientists, and reviewed the available literature on rockfish and rockfish management in the North Pacific. The committee members released their reports in late-July 2006.

This proposal is not further analyzed because (1) the precautionary elements built in to rockfish stock modeling, (2) preliminary work suggests that F_{MSY} may be relatively insensitive to maternal effects, (3) independent expert evaluation of rockfish management, and NMFS evaluation of the results of the evaluation, are ongoing but incomplete, and (4) determination of OFL and ABC are not a part of this action. NMFS notes that the addition of Alternative 4, which sets rockfish fishing rates at $F_{75\%}$ should help address concerns for the evaluation of additional precaution in rockfish management.

Comment: Consider catch of pollock in the United States and Russian waters as total landings and in determinations of the Eastern Bering Sea pollock TAC.

Response: As a part of the annual specifications process, NMFS AFSC stock assessment scientists currently prepare a model which includes Russian catches in the northern Bering Sea. In this model (Model 6 in the 2005 SAFE), catches from the Navarin Basin area are added to U.S. EBS shelf region catches and submitted to the stock-assessment model for analysis. This model is used primarily as a sensitivity analysis to Russian catches. Including Russian catches explicitly in the assessment inflated the biomass estimates considerably, but had little effect on resource resiliency estimates. (NPFMC 2005). This proposal is not further analyzed, because Russian pollock catches are already considered in development of the annual OFL and ABC recommendations.

Comment: Set TACs using a higher natural mortality rate that deducts from the ABC 50 percent of the biomass for ecosystem needs for each group of species (the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) approach).

Response: The commenter may confuse natural mortality with fishing mortality. NMFS scientists use natural mortality rates that are based on the best scientific information available. Setting TACs at one-half ABC was the “conservative alternative” in previous EAs for the harvest specifications. It was eliminated from detailed study in this EIS because it does not produce TACs within the OY range and is not justified for all groundfish species. Alternative 4 replaces this alternative as a “conservative alternative.”

For these reasons, and because OFL and ABC determinations, and the methods used to make these determinations, are not within the scope of this action, this proposal is not analyzed further.

Comment: Constrain TACs by ecosystem components such as northern fur seals.

Response: In response to this and similar comments, Alternative 4 was structured to set lower harvest rates. The stock assessments used to establish the ABCs and OFLs incorporate ecosystem components, as explained in the SAFE report. Additionally, this EIS analyzes the effects of alternative harvest strategies on ecosystem components, including northern fur seals.

Comment: *Set OY to include marine mammals getting a percentage of the catch.*

Response: Presumably this commenter would like to see the upper bounds of the OY ranges in the BSAI and GOA reduced. However, determination of OY is outside the scope of this action. A change in the upper limit of the OY in the BSAI would require Congressional action because the OY is specified in Section 803 of the Consolidated Appropriations Act of 2004 (Public Law 108-199). Changes in the lower limit of the OY in the BSAI, and of the upper and lower limits in the GOA, would require an FMP amendment. Alternative 4 reduces harvests in the GOA and BSAI to the lower end of the OY ranges currently in the FMPs.

Comment: Set spatially explicit ABC and OFL levels for rockfish that coincide with population distributions.

Response: This EIS addresses this comment by making separate rougheye and shortraker TACs in the AI and the EBS a part of Alternative 4. This was a topic of interest in 2005 Groundfish Plan Team meetings. However, the determination of ABC and OFL levels for rockfish are scientific issues that fall outside the scope of this action.

2.5.3 Temporal and spatial measures

Public comments suggested a number of measures to close areas to groundfish fishing and spread out harvest levels through the year. Current regulations at 50 CFR 679.22 include many closed areas for various reasons, including Steller sea lion and EFH/HAPC protection. Harvest specifications are implemented within the context of existing closures. Additional closed areas would require regulatory change, specific detailed analysis, and are outside the scope of this action.

Comment: Prohibit trawling in critical habitat.

Response: Presumably this comment refers to habitat designated as critical under the ESA, which applies only to Steller sea lions and northern right whales. Existing Steller sea lion protection measures prohibit trawling in large portions of critical habitat. The Council's Steller Sea Lion Mitigation Committee is currently reviewing the best available information and may recommend revising existing protection measures for Steller sea lion critical habitat. This potential future action is outside the scope of this proposed action. NMFS completed an informal consultation on the effects of the groundfish fisheries on proposed norther right whale critical habitat and determined that the groundfish fisheries were not likely to adversely affect designated critical habitat in the Bering Sea or in the GOA (Brix 2006).

Comment: Spread out harvest levels through the year and disperse highly concentrated fisheries in time and space to avoid localized impacts to habitat, non-target species, and other ecosystem components.

Response: The groundfish FMPs and regulations include many provisions designed to temporally and spatially disperse fisheries. The comment does not identify the species of concern, or the types of measures that are desired. The existing Steller sea lion protection measures mandate temporal and spatial dispersion of harvests of pollock, Pacific cod, and Atka mackerel. The TACs for many other fisheries are currently divided among management areas within a region – particularly in the GOA. Additionally, halibut PSC apportionments disperse concentrated fisheries by closing regions with high bycatch rates.

One of the primary results of rationalization programs is to slow the race for fish and spread harvest over longer seasons. This is evident in the fisheries under existing rationalization programs: halibut/sablefish fishery, the AFA pollock cooperative fishery, and the BSAI crab fisheries. The Council and NMFS are in the process of developing a rationalization program for additional fisheries in the BSAI and GOA, including the non-AFA trawl catcher/processor fleet, GOA groundfish rationalization, Pacific cod sector allocations, and the Rockfish Pilot Program. In summary, NMFS and the Council have taken many actions to disperse the groundfish fisheries and see no basis on which to add additional measures into this analysis.

Comment: Implement closures within a one hundred-mile radius around the Pribilof Islands and a fifty-mile radius around Zhemchug Canyon.

Response: While this EIS will provide a more detailed review of the impact of fishing activity on marine mammals in the Pribilof Islands region than past analyses, area closures are outside the scope of this action and are not further analyzed. The existing Pribilof Islands Habitat Conservation Area closes approximately 7,000 nautical miles year-round to groundfish fishing. The Council's Plan Teams have reviewed HAPC proposals to close Zhemchug Canyon, however, they were not carried forward for Council review. Additionally, the Council is undertaking a separate analysis to consider potential new management measures to minimize the effects of fishing on seafloor habitats in the Bering Sea. As part of that process, the Council is accepting public comments on potential area closures, gear restrictions, or other measures.

Comment: Use time/area closures in the GOA to prohibit fishing with trawl gear on Tanner crab fishing grounds.

Response: It is not clear what new areas the commenter would like to see closed. Existing Federal and State closure areas protect Tanner crab stocks in the GOA. Existing closed areas in the GOA to protect red king crab habitat, a Southeast Alaska trawl closure, and Steller sea lion critical habitat closures benefit Tanner crab stocks as well. The Council has prepared an analysis of additional closed areas and other measures to protect Tanner crab in the GOA and these will be examined along with GOA rationalization. Because this request is outside the scope of this action, it is not further analyzed.

Comment: Design rockfish refugia around bycatch hotspots and important habitat.

Response: Under the EFH/HAPC actions, NMFS and the Council have taken steps to protect rockfish habitat in the GOA and the BSAI. Amendments 78/65 and 73/65 to the BSAI and GOA groundfish FMPs, respectively, established closed areas in sensitive habitat areas of the AI and GOA that are used by rockfish (71 FR 36694, June 28, 2006). Because this request is outside the scope of this action, it is not further analyzed.

Comment: Establish marine protected areas based on ecological criteria.

Response: NMFS and the Council have adopted a wide variety of marine protected areas to minimize the effects of fishing on habitat, reduce interactions with protected species, minimize bycatch, and for other purposes. These areas and the associated management restrictions were each developed based on site-specific considerations and relevant ecological criteria. NMFS and the Council will consider additional marine protected areas in the future as warranted. For example, the Council has established a process to consider identifying new HAPC every few years based on four considerations: the importance of the ecological function provided by the habitat; the extent to which the habitat is sensitive to human-induced environmental degradation; the extent to which development activities may be stressing the habitat; and the rarity of the habitat. Because establishing additional marine protected areas is outside the scope of this action, they are not further analyzed.

2.5.4 Additional measures

Public comments suggested five additional measures that are beyond the scope of this analysis because they require regulatory or FMP changes to measures that are not part of the proposed action.

Comment: Include mitigation measures to protect communities.

Response: The Council and NMFS have adopted many measures to mitigate social and economic impacts of groundfish harvests. Mitigation measures incorporated into the harvest specifications include, (1) the CDQ program, (2) limits on prohibited species catches, (3) accommodation of the State's GOA and AI Pacific cod GHL levels by setting TACs below ABCs, (4) the Aleut Corporation's pollock allocation, and (5) the GOA pollock and Pacific cod inshore-offshore split. Existing measures to mitigate fisheries effects on habitat and ecosystem resources alleviate impacts on local communities as well. The comment did not suggest specific mitigation measures and any additional mitigation measures would require a separate specific analysis and are outside the scope of this action.

Alternatives 3 and 4 evaluate significant reductions in the fishing rates. These alternatives will make it possible to highlight the tradeoffs between the alternatives with respect to community impacts.

Comment: Increase observer coverage in the GOA groundfish fisheries.

Response: Observer coverage measures are beyond the scope of this action and changes to the observer program would be a separate action. This proposal was introduced in a comment dealing with potential groundfish trawl impacts on Tanner crab. Much of the impact described in that comment dealt with damage to crab on the bottom from the passage of trawl gear. It is not clear that increased observer coverage would provide information on this issue. NMFS is currently developing new tools to augment observer coverage, such as video monitoring. The comment did not present information to lead NMFS to consider additional observer coverage as part of this action. Additionally, changes to observer coverage outside the scope of this analysis. Chapter 7 addresses the Tanner crab bycatch in the GOA groundfish fisheries.

Comment: In order reduce discards and waste, include measures such as kill caps on prohibited and protected species.

Response: Many existing regulations reduce discards and waste, including groundfish retention standards, increase retention increased utilization (IRIU) provisions, and maximum retainable amount (MRA) provisions. The rationalization programs (Rockfish Pilot Program, Amendment 80, and GOA Rationalization) under development by the Council and NMFS include additional measures for bycatch accounting and to reduce discards and waste. The existing PSC limits established for halibut, herring, crab, and salmon, are limits on mortality. The comment did not present information to lead NMFS to consider additional measures as part of this action.

Comment: Restrict gear types and phase out dirty gear such as bottom trawls.

Response: The Council and NMFS have adopted many measures to restrict or modify gear to reduce impacts such as destruction of habitat and bycatch. These include restrictions on the physical construction of gear and restrictions on the areas within which gears may be used (for example, the restrictions associated with the recent EFH/HAPC action). The Council is currently considering further actions, for example, possible new EFH/HAPC measures in the Bering Sea.

The Council and NMFS also have adopted many measures to control bycatch of other living species. Measures to control bycatch of other fish species include PSC protection measures, groundfish retention standards, IRIU provisions, MRA provisions, and OFL-TAC controls implemented by in-season fishery managers. Industry is also active in taking steps to control bycatch through the fishing industry contracts with private sector monitoring companies such as SeaState, and through ongoing research into halibut and salmon excluder devices. Measures to control bycatch of marine mammals and seabirds include closures of areas used by Steller sea lions and seabird avoidance measures. The comment is not specific with respect to the additional measures desired and did not present information to lead NMFS to consider additional measures at this time. Additionally, gear modification measures are outside of the scope of this action.

Comment: Reducing discards and waste by designating target species for which there is not adequate information to set the biological reference points and minimum stock size thresholds as "bycatch only" with full utilization and retention and with area and species-specific hard caps.

Response: The only mechanism available to NMFS to accomplish this action through the specifications would be to set TACs so low that no directed fishery would be possible. Alternative 4 would set low, precautionary TACs for rockfish in Tier 5, as requested by public comment. These TACs may be low enough to preclude targeted fisheries for these species. If so, the bycatch only fishery would have a good biological and management rationale.

NMFS has determined the Council's recommended TAC levels are insufficient to support directed fisheries given incidental catch needs in other groundfish fisheries. Accordingly, many groundfish species are already designated as incidental catch only for the entire year. For the BSAI, these species are "other" rockfish, northern rockfish, shortraker rockfish, rougheye rockfish, "other species," and Bering Sea Pacific ocean perch. For the GOA, these species are Atka mackerel, thornyhead rockfish, shortraker rockfish, rougheye rockfish, "other" rockfish, and skates.

The final rule implementing Amendment 69 to the GOA FMP permits the Council to recommend a TAC for the "other species" complex in the GOA at a level sufficient to meet incidental catch needs as well as developing this target as a sustainable fishery (71 FR 12626, March 13, 2006). In the BSAI in recent years the Council has recommended a TAC for the "other species" complex anticipated to meet, but not exceed, incidental catch needs.

Other approaches to identifying bycatch only fisheries would require FMP or regulatory changes that are outside the scope of this action. Similarly, requirements for full utilization and retention, and area and species-specific hard caps, would require regulatory amendments that are outside the scope of this action.

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2.7 Preparers and Persons Consulted

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Chapter 3 Affected Environment

3.1 North Pacific Environment

The action area effectively covers all of the Gulf of Alaska, Bering Sea, and Aleutian Islands, under U.S. jurisdiction, extending southward to include the waters south of the Aleutian Islands west of 170°W to the border of the EEZ (Figure 1). The marine waters of the State of Alaska (State) have been treated as a part of the action area because vessels fishing in Federal waters pass through State waters, and because some fishing for Federal TACs takes place in State waters. Effects of this action are limited to these areas.

A comprehensive description of the action area is contained in previous EISs prepared for North Pacific fishery management actions. The description of the affected environment is incorporated by reference from Chapter 3 of the PSEIS (NMFS 2004a) and Chapter 3 of the EFH EIS (NMFS 2005a). These documents contain extensive information on the fishery management areas, marine resources, habitat, ecosystem, social, and economic parameters of these fisheries. Rather than duplicate an affected environment description here, readers are referred to those documents. Both of these public documents are readily available in printed form or on the Internet at www.fakr.noaa.gov.

Relevant and recent information on each of the resource components analyzed in this EIS is contained in the chapter addressing that resource component and is not repeated here in Chapter 3.

3.2 Harvest Specifications[5] and In-season management

Fishing areas and harvest controls

Harvest specifications set upper limits on total (retained and discarded) catches for a fishing year. These upper limits (OFLs, ABCs, and TACs, as defined at the start of Chapter 1) are set for each "target species" and "other species" category defined in the FMPs or harvest specifications.

Sub-allocations of the OFLs, ABCs, and TACs may be made for biological, economic, and/or socio-economic reasons according to percentage formulas established through FMP amendments. Harvest specifications may be allocated among the following:

- districts or subareas within management areas (e.g., Eastern, Central, Western Aleutian Islands; Bering Sea; Western, Central, and Eastern GOA),
- management programs (American Fisheries Act or Community Development Quota program),
- processing components (inshore or offshore),
- gear types (trawl, non-trawl, hook-and-line, pot, jig),
- seasons.

These allocations are made according to regulations at 50 CFR 679.20, 679.23, and 679.31. TAC can be further allocated to the various gear groups, management areas, and seasons according to pre-determined regulatory actions, and by regulatory announcements by NMFS, opening and closing fisheries accordingly. No foreign fisheries are conducted in the EEZ off Alaska and, therefore, the entire TAC amount is available to the domestic fishery.

Fishing areas correspond to the defined regulatory areas within the fishery management units. The BSAI is divided into nineteen reporting areas, some of which are combined for harvest specifications purposes. The GOA is divided into eight reporting areas. The BSAI and GOA regions, with most management areas, are shown in Figure 1-1.

The fishing year coincides with the calendar year, January 1 through December 31 (50 CFR §679.20 and §679.23). Depending on the target species' temporal allocation, additional harvest specifications are made to particular seasons within the fishing year. Groundfish TACs not harvested during a fishing year are not rolled over from that year to the next. NMFS opens and closes fisheries by an announcement in the Federal Register. Closures are made when inseason information indicates the apportioned TAC, or available PSC limit,[6] has been or will soon be reached, or at the end of the specified season, if the particular TAC has not been taken.

Harvest specifications for the Federal groundfish fisheries are set each year for two years, the upcoming year and the year that follows that. The process includes review of the annual SAFE reports, including the Ecosystem and Economic reports by the Council, its AP, and its SSC. Using the information from the SAFE reports and the advice from Council committees, the Council makes harvest specification

[5] The process described in this section is implemented pursuant to Amendments 48/48 to the FMPs for the GOA and BSAI, respectively. Amendments 48/48 were unanimously recommended by the Council in October 2003. A notice of availability for the FMP amendments was published on July 14, 2004 (69 FR 42128), and a proposed rule was published on July 27, 2004 (69 FR 44634). The Secretary approved the amendments, and the final rule was published on November 8, 2004 (69 FR 64683).

[6] BSAI crab, halibut, salmon, and herring limits are established in regulations and the Council recommends target fishery and seasonal apportionments of these PSC limits. The Council recommends the GOA halibut PSC limits, fishery, and seasonal apportionments.

recommendations in December, for the next two years. The Secretary reviews and makes a determination whether to approve the recommendations. If the Secretary approves the recommendations, NMFS implements the harvest specifications through rulemaking.

Plan Teams and SAFE documents

The groups responsible for analyzing and packaging fisheries data for Council consideration are the Council's Groundfish Plan Teams (Plan Teams). There are separate Plan Teams for the BSAI and GOA. These teams include NMFS scientists and managers, Alaska, Oregon, and Washington fisheries management agencies' scientists, and university faculty.

The Plan Teams use stock assessments prepared annually by NMFS and by ADF&G to calculate biomass, OFL, and ABC for each species or species group, for specified management areas of the EEZ off Alaska. Plan Team meetings are held in September to review potential model changes, and are used for developing proposed ABC recommendations. In November, the Plan Teams' rationale, models, and resulting ABC and OFL calculations are documented in annual SAFE reports. Stock survey information from the field, collected the preceding summer, is an important input into these November calculations. The SAFE reports incorporate recently completed biological survey work, any new methodologies, and ABC and OFL determinations based on the most recent stock assessments. Periodically, an independent expert panel reviews the assumptions used in the stock assessments for a selected species or species group, and may provide recommendations on improving the assessment.

At its December meetings, the Council, its AP, its SSC, and interested members of the public, review the November SAFE and Plan Team reports and make recommendations on harvest specifications for the next two years. The harvest specifications recommended by the Council, therefore, are based on scientific information, including projected biomass trends, information on assumed distribution of stock biomass, and revised technical methods used to calculate stock biomass. SAFE and Plan Team reports are part of the permanent record of the harvest specifications process.

To provide consistency between the groundfish FMPs for the harvest specifications process and flexibility during the harvest specifications process, the FMPs permit the Council to set harvest specifications for up to two fishing years. The stock assessment models used for determining the harvest specifications use 2-year projections for biomass and ABC.

Proposed and final harvest specifications

The specification of the upcoming year's harvest levels is currently a two-step process. In the first step, proposed harvest specifications, including OFLs, ABCs, TACs, and PSC limits, are recommended by the Council at its October meeting and published in November or December in the *Federal Register* for public review and comment.

In October, most current year stock assessments are not yet available. Proposed harvest specifications for a number of target species are based on AFSC projections using stock population models and preliminary projections of current year fisheries mortality. The proposed harvest specifications for other species, for which little stock assessment information is available, are based on rollovers of the current year's harvest specifications.

For most BSAI target species, the initial TAC (ITAC) is calculated as 85 percent of the proposed TACs (50 CFR § 679.20(b)). The remaining 15 percent is split evenly between the Western Alaska Community Development Quota (CDQ) program reserve (for harvest by CDQ groups) and a non-specified groundfish reserve (to provide in-season management flexibility). Pollock is handled somewhat differently; 10

percent of the TAC is allocated to a CDQ reserve, and the remainder is allocated to a pollock ITAC. Sablefish is also handled differently; 20 percent of the sablefish hook-and-line and pot gear allocations are placed in the CDQ reserve. There are no non-specified reserves for either pollock or sablefish.

In the GOA, 20 percent of each TAC for pollock, Pacific cod, flatfish, and "other species" is set aside as a reserve. Since 2001, the harvest specifications have reapportioned the reserves to the full TAC for these species.

In the second step, final TAC and PSC specifications are recommended by the Council at its December meeting, following completion of analysis of any new stock status information. These TAC specifications and PSC limits, and apportionments thereof, are recommended to the Secretary for implementation in the upcoming fishing year. With the BSAI final harvest specifications, many of the non-CDQ reserves are released, and the final ITAC is increased by the amount of reserves released. Currently, the final harvest specifications are typically implemented in February or March, and replace the current harvest specifications as soon as they are in effect.[7]

Rulemaking and publication of the harvest specifications

The NMFS Alaska Region's Sustainable Fisheries Division drafts the harvest specification rule packages, with review by the Region's Protected Resources Division, Habitat Conservation Division, Restricted Access Management Division, Regional Economist, the Regional NOAA Office of Law Enforcement, and the Regional Office of NOAA General Counsel.

After Regional review is completed, the rule is forwarded to NMFS Headquarters, for clearance by NOAA and the Department of Commerce (DOC) General Counsel. After the rule has cleared NOAA, and DOC, the rule is forwarded to the Office of the Federal Register.

The NOAA and DOC review can 30 days for a proposed rule, but can take longer depending on the complexity of the rule, degree of controversy, or other workload priorities within different review tiers. The review process is repeated for the final rule.

During its review, NMFS must determine if the final harvest specifications are a logical outgrowth of the proposed harvest specifications. If the final harvest specifications recommendations are consistent with applicable law and are a logical outgrowth of the proposed harvest specifications, the final harvest specifications may be published without additional public review and comment. If the final harvest specifications recommendations are not a logical outgrowth of the proposed harvest specifications, an additional publication of proposed harvest specifications may be needed to provide an additional opportunity for prior public review and comment under the APA. In May or June of the following year, the final harvest specifications could be published, based on the additional proposed harvest specifications and after consideration of public comment. Alternatively, depending on the circumstances, NMFS may find "good cause" to waive the additional publication of proposed harvest specifications for prior public review and comment. In this case, the final harvest specifications would likely become effective in February or March. To date, NMFS has never determined that the final harvest specifications were not a logical outgrowth of the proposed harvest specifications.

[7] The Central Gulf of Alaska Rockfish Pilot Program will allocate rockfish, associated groundfish, halibut PSC limits, and groundfish sideboard limits to a specific group of eligible harvesters in 2007. These amounts are expected to be identified in September 2006 and would modify the harvest specifications for 2007. They would not, however, modify OFLs, ABCs, or TACs.

To provide opportunity for an additional public comment period after the Council's final harvest specifications recommendation in December, without disrupting the fisheries, which typically begin early in the new year, the groundfish fisheries in the new fishing year are initially managed on the harvest specifications that have been previously published. This is possible because the Council adopts harvest specifications for two years at a time. Each year the harvest specifications that begin the season are superseded by the new annual harvest specifications.

Harvest specifications for the hook-and-line gear and pot gear sablefish individual fishing quota (IFQ) fisheries are limited to the succeeding fishing year to ensure those fisheries are conducted concurrent with the halibut IFQ fishery. Having the sablefish IFQ fisheries concurrent with the halibut IFQ fishery reduces the potential for discards of halibut and sablefish in these fisheries. The sablefish IFQ fisheries remain closed at the beginning of each fishing year until the final harvest specifications for the sablefish IFQ fisheries are in effect. The trawl sablefish fishery is managed using harvest specifications for two years, along with the remaining target species in the BSAI and with GOA pollock, Pacific cod, and the "other species" complex.

In-season management

The In-season Management Branch of the Alaska Region monitors the rate of catch of groundfish and prohibited species relative to the specifications. Through fishery closures and openings the branch manages the harvest schedule to attain optimum yield. The Alaska Region manages 240 TACs in the BSAI and GOA, comprised of over 50 individual species. Both retained and discarded fish are credited against species specific TACs. Quotas are managed using observer data and industry reports. Including sideboards, but not including individual fishing quotas, about 500 quotas are generated each year.

The In-season Management Branch writes the proposed and final rules that establish the annual harvest specifications. The group supports the Regional Administrator in the day-to-day operations of the fisheries using the harvest specifications and standing regulations. The branch compiles catch and production data from at-sea catcher/processor vessels, motherships, floating shoreside and on-shore plants, and groundfish observers. In-season Management announces openings and closures using information bulletins and publications in the *Federal Register*. Processors, vessel operators, other fishing industry servicing businesses, and the media are quickly notified of any actions, through postings on the Alaska Region web site at www.fakr.noaa.gov.

The In-season Management Branch determines the amount of an individual TAC necessary as incidental catch (the incidental catch account (ICA)) in other target fisheries. For example Pacific cod taken incidentally in a pollock target fishery contributes to the Pacific cod ICA. After deducting the ICA, the remaining TAC is the directed fishing allowance (DFA), which allows vessels full retention of the species. Once the DFA is caught the fishery closes. Closure limits retention to a portion of other TACs, open to directed fishing. That portion is called the maximum retainable amount (MRA). The MRA is a percentage of an alternate target fishery. The percentage relates to the expected rate of catch, and may be used as a tool to harvest a species that is low in volume but high in value. Retention is prohibited if the total TAC is caught before the end of the year. Retention prohibition removes any incentive to increase incidental catch as a portion of other fisheries. If the ABC is taken and the trajectory of catch indicates the OFL may be approached, additional closures are imposed. To prevent overfishing, specific fisheries, identified by gear and area that incur the greatest incidental catch, are closed. Closures expand to other fisheries if the rate of take is not sufficiently slowed. Overfishing closures are rare in the BSAI and GOA.

In the Bering Sea pollock, Aleutian Island pollock, and CDQ fisheries, allocations are granted to particular groups. In exchange, the recipients are responsible for monitoring and limiting their catch, rather than the agency imposing fishing time limits.

A fishery may also be closed if a PSC limit of halibut, crab, salmon, or herring is taken. Other than for scientific purposes or donations programs, prohibited species may not be retained in the groundfish fisheries.

In the BSAI, a quota reserve system plays an important role in managing the groundfish TACs. With the exception of pollock and the hook-and-line and pot gear allocation of sablefish, fifteen percent of each TAC is set aside in the reserve. The harvest specifications allocate one half of the reserve, or 7.5 percent of most species, twenty percent of the hook-and-line and pot gear allocation of sablefish, and ten percent of the BSAI pollock TACs to the CDQ program. Required by Congress, the CDQ program provides an economic engine for development programs for qualifying communities in western Alaska. The non-CDQ portion of the reserve is not specific to a particular species TAC, and functions as a common pool to supplement particular fisheries. The reserve system provides a limited amount of flexibility to respond to yearly fluctuations in catch rates, and thereby maximizes value to the industry. Management has the option of increasing an individual TAC beyond that originally specified, up to its ABC, so long as the OY is not exceeded. In the GOA, the reserve system isn't normally used. All the reserves are released back to each TAC and there is no CDQ allocation.

Management of groundfish stocks in the Alaska Region has been, and is expected to continue to be, successful. Most stocks are considered healthy. Some stocks are currently above their long term average, and some below. In general, stock size increases and decreases with variable recruitment strengths, driven to some extent by ecological and environmental conditions. Catches are closely monitored, conservatively managed, and kept within ABC limits. For many stocks, TAC is set at or less than 90 percent of ABC. For all stocks, ABC's are less than overfishing levels. When the OFL is approached, regulations require conservative action to prevent overfishing. The Council and NMFS have developed and continue to develop, programs responding to a complex of ecological, social, and economic factors.

3.3 Reasonably foreseeable future actions

This section lists the reasonably foreseeable actions that may affect the groundfish fisheries in the GOA and the BSAI and the impacts of the fisheries on the environment. The actions in the list have been grouped in the following five categories:

- Ecosystem-sensitive management (Section 3.3.1)
- Fishery rationalization (Section 3.3.2)
- Traditional management tools (Section 3.3.3)
- Actions by other Federal, State, and international agencies (Section 3.3.4)
- Private actions (Section 3.3.5)

The specifications "action area" includes the Federal waters of the EEZ off of Alaska, as well as State of Alaska marine waters, because some of the managed fish stocks are found in both.

Table 3-1 summarizes the reasonably foreseeable "actions" identified in this analysis that are likely to have an impact on a resource component within the action area and timeframe. Actions are understood to be human actions (e.g., a proposed rule to designate northern right whale critical habitat in the Pacific Ocean), as distinguished from natural events (e.g., an ecological regime shift). CEQ regulations require a consideration of actions, whether taken by a government or by private persons, which are reasonably foreseeable. This is interpreted as indicating actions that are more than merely possible or speculative. Actions have been considered reasonably foreseeable if some concrete step has been taken toward implementation, such as a Council recommendation or the publication of a proposed rule. Actions simply “under consideration” have not generally been included because they may change substantially or may not be adopted, and so cannot be reasonably described, predicted, or foreseen. Identification of actions likely to impact a resource component within this action’s area and time frame will allow the public and Council to make a reasoned choice among alternatives.

Table 3-1 Reasonably foreseeable future actions

Ecosystem-sensitive management	• Increasing understanding of the interactions between ecosystem components, and on-going efforts to bring these understandings to bear in stock assessments • Increasing protection of ESA-listed and other non-target species components of the ecosystem • Increasing integration of ecosystems considerations into fisheries decision-making
Fishery rationalization	• Continuing rationalization of Federal fisheries off Alaska • Fewer, more profitable, fishing operations • Better harvest and bycatch control • Rationalization of groundfish in Alaskan waters • Expansion of community participation in rationalization programs
Traditional management tools	• Authorization of groundfish fisheries in future years • Increasing enforcement responsibilities • Technical and program changes that will improve enforcement and management
Other Federal, State, and international agencies	• Future exploration and development of offshore mineral resources • Reductions in United States Coast Guard fisheries enforcement activities • Continuing oversight of seabirds and some marine mammal species by the USFWS • Expansion and construction of boat harbors • Expansion of State groundfish fisheries • Other State actions • Ongoing EPA monitoring of seafood processor effluent discharges
Private actions	• Commercial fishing • Increasing levels of economic activity in Alaska’s waters and coastal zone • Expansion of aquaculture

3.3.1 Developments in Ecosystem-sensitive management[8]

Increasing understanding of the interactions between ecosystem components, and on-going efforts to bring these understandings to bear in stock assessments

Researchers are learning more about the components of the ecosystem, the ways these interact, and the impacts of fishing activity on them. Research topics include cumulative impacts of climate change on the ecosystem, the energy flow within an ecosystem, and the impacts of fishing on the ecosystem components.

[8] The term “ecosystem-sensitive management” is used in this EIS in preference to the terms “ecosystem-based management” and “ecosystem approaches to management.” The term was chosen to indicate a wide range of measures designed to improve our understanding of the interactions between groundfish fishing and the broader ecosystems, to reduce or mitigate the impacts of fishing on the ecosystems, and to modify fisheries governance to integrate ecosystems considerations into management. The term was used because it is not a term of art of commonly used term which might have very specific meanings. When the term “ecosystem-based management is used,” it is meant to reflect usage by other parties in public discussions.

Many institutions and organizations are conducting relevant research. The AFSC provides a particularly important example of these efforts. The AFSC's Fishery Interaction Team (FIT), formed in 2000 to investigate the ecological impacts of commercial fishing, and is focusing on the impacts of Pacific cod, pollock, and Atka mackerel fisheries on Steller sea lion populations (Connors and Logerwell 2005). The AFSC Fisheries and the Environment (FATE) program is investigating potential ecological indicators for use in stock assessment (Boldt 2005). The AFSC's Auke Bay Lab and RACE Division map the benthic habitat on important fishing grounds, study the impact of fishing gear on different types of habitats, and model the relationship between benthic habitat features and fishing activity (Heifetz et al. 2003). Other AFSC ecosystem programs include the North Pacific Climate Regimes and Ecosystem Productivity Program, the Habitat and Ecological Processes program, and the Loss of Sea Ice program (J. Boldt, pers. comm., September 26, 2005).

The interface between science and policy-making should also improve. For example, the ongoing development of multi-species population models in the Resource Ecology & Ecosystem Modeling program (Aydin and Jurado-Molina 2005) should facilitate the integration of multi-species considerations into the determination of overfishing criteria (OFLs and ABCs), and TACs for individual species. The annual Ecosystems Considerations appendix to the SAFE document has been enhanced in recent years, and the AFSC has begun to move its production forward in time, so that early versions are now being produced in the spring, rather than the fall. Moreover, a new website is under development for wider distribution of the SAFE's data sets. These developments should facilitate the use of ecological information in making policy.

Increasing protection of ESA-listed and other non-target species components of the ecosystem

Groundfish fishing may impact a wide range of other resources, such as benthic habitat, seabirds, marine mammals, and non-target species, such as crab, salmon, grenadiers, smelt, or halibut. Recent Council and NMFS actions and ongoing research suggest that the Council and NMFS will adopt measures for additional protection of some of these resources in the near future.

In February 2005, the Council adopted a preferred alternative to define and protect EFH and HAPC in the GOA and the AI. NMFS approved the FMP amendments and issued a final rule to implement these measures (71 FR 36694; June 28, 2006). Additionally, the Council is considering the development of actions to mitigate fishing impacts on EFH in the Bering Sea.

The Council and NMFS are also likely to adopt measures to protect non-target fish species to a greater extent. In 2004, regulations were revised to separate skates from other species in the GOA (69 FR 26313, May 12, 2004). In 2005, the Council took final action to allow more flexibility to constrain the TAC for the remaining "other species" complex in the GOA. NMFS implemented regulations to accomplish this on March 13, 2006 (71 FR 12626). Under these new regulations, AFSC scientists are producing more detailed SAFE analyses with a breakout for the BSAI other species complex. Planning is underway to breakout the GOA other species in a subsequent years. Proposed Amendment 84 would modify bycatch reduction measures for Chinook and chum salmon in the BSAI to address high levels of bycatch in the pollock fishery. In the longer term, the Council is expected to look at alternatives to analyze new regulatory savings area closures as well as individual vessel accountability programs. In conjunction with Gulf of Alaska rationalization, the Council is reviewing methodologies for establishing trigger limits, by gear type, closures area, and hot spot management for PSC species in the GOA (G. Merrill, pers. comm., September 26, 2005).

The Council has adopted measures for Improved Retention and Improved Utilization (IRIU) for the BSAI flatfish fisheries, resulting in reduced discards in those fisheries. The Council has recommended, and the Secretary has approved, Amendment 79 to the BSAI FMP, which permits the use of a groundfish retention standard in the BSAI flatfish fishery. NMFS published a final rule to implement Amendment 79 (71 FR 17362; April 6, 2006).

In 2004, NMFS published a final rule to require longline vessels to adopt certain bird protection measures (69 FR 1930). These measures may have contributed to the reduction in bird bycatch rates for longline fishing operations. Research is currently underway to address seabird interactions with trawl fisheries. A September 2003 BiOp issued by the USFWS identifies this issue as needing additional study. The BiOp requires NMFS to develop a means to assess these interactions, and recommends the development of methods to minimize seabird collisions with trawl wires.

Washington State's Sea Grant program is currently working with catcher-processors in the BSAI pollock fishery to study the sources of seabird strikes in their operations and to look for ways fishermen can reduce the rate of strikes (Melvin et al. 2004). Other studies are investigating the potential for use of video monitoring of seabird interactions with trawl and longline gear (McElderry et al. 2004; Ames et al. 2005). The Council is considering a proposal to remove requirements for seabird protection measures from small hook-and-line vessels operating within specific State 'inside' waters in areas where recent research indicates that hook-and-line operations attract relatively few seabirds.

Changes in the status of species listed under the ESA, the addition of new listed species, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. NMFS has found that designating northern right whales occurring in the Pacific Ocean as a separate species from those occurring in the Atlantic Ocean is warranted (71 FR 4344, January 26, 2006). NMFS is going through a status review regarding ESA listing of the separate species called the North Pacific right whale (*Eubaleana japonica*). If the species is listed re-initiation of Section 7 consultation will be required for the groundfish fisheries to determine if activities may adversely affect the North Pacific right whales.

In June 2004, the Council changed Steller sea lion fisheries restrictions for pollock and Pacific cod in the GOA. Fisheries were opened adjacent to several haulout sites and further restricted at others. Measures were carefully designed to avoid adverse modification of critical habitat or jeopardy to the Steller sea lions. NMFS has reinitiated the consultation on the FMP-level BiOp and Steller sea lion BiOp due to changes in the Federal action and due to new information about ESA-listed species and their critical habitat. As new information becomes available for Steller sea lions, and particularly when the Steller Sea Lion Recovery Plan is finalized, NMFS may consider changes in the listing status of both the eastern and the western DPSs of this marine mammal.

The USFWS is considering an ESA listing for the Kittlitz's murrelet. This species has declined in abundance in recent years. The reasons for the decline of the Kittlitz's murrelet population are unknown; some hypotheses that have been advanced include changes in preferred habitat due to tidewater glacial retreat, disturbance from increased marine traffic (particularly from tourist operations in preferred habitat areas), and lack of forage (Kuletz 2004). Listing of the Kittlitz's murrelet would require NMFS to ensure that actions it authorizes (e.g., commercial groundfish fisheries) are not likely to jeopardize the existence of these species or adversely modify or destroy any designated critical habitat.

The northern fur seal population in the Pribilof Islands has been declining, with pup production down 15.7 percent on St. Paul Island and 4.1 percent on St. George Island between 2002 and 2004 (Towell et al. 2006). In June 2003, the Council appointed a Fur Seal Committee to monitor preparation of the EIS for subsistence harvest and to make recommendations for further Council action. Continued concern for fur seals and potential interaction with the groundfish fisheries, may result in protection measures implemented for the groundfish fisheries.

Increasing integration of ecosystems considerations into fisheries decision-making

Ecosystem assessments evaluate the state of the environment, including monitoring climate–ocean indices and indicator species to detect ecosystem changes. Ecosystem-based fisheries management reflects the incorporation of ecosystem assessments into single species assessments when making management decisions and explicitly accounts for ecosystem processes when formulating management actions. Ecosystem-based fisheries management may still encompass traditional management tools, such as TACs, but these tools will likely yield different quantitative results.

To integrate such factors into fisheries management, NMFS and the Council will need to develop policies that explicitly specify decision rules and actions to be taken in response to preliminary indications that a regime shift has occurred. These decision rules need to be included in long-range policies and plans. Management actions should consider the life history of the species of interest and can encompass varying response times, depending on the species' lifespan and rate of production. Stock assessment advice needs to explicitly indicate the likely consequences of alternate harvest strategies to stock viability under various recruitment assumptions.

Management strategy evaluations (MSEs) can help in this process. MSEs use simulation models of a fishery to test the success of different management strategies under different sets of fishery conditions, such as shifts in ecosystem regimes. The AFSC is actively involved in conducting MSEs for several groundfish fisheries, including for several flatfish species in the BS, and for pollock in the GOA.

Both the recent Pew Commission report and the Oceans Commission report point to the need for changes in the organization of fisheries and oceans management to institutionalize ecosystem considerations in policy making (Pew 2003; U.S. Commission on Ocean Policy 2004). The Oceans Commission, for example, points to the need to develop new management boundaries corresponding to large marine ecosystems, and to align decision-making with these boundaries (U.S. Commission on Ocean Policy 2004).

Since the publication of the Oceans Commission report, the President has established a cabinet-level Committee on Ocean Policy by executive order. The Committee is to explore ways to structure government to implement ecosystem-based ocean management (Evans and Wilson 2005). Congress is preparing to reauthorize the Magnuson-Stevens Act. The reauthorization is widely expected to address ecosystem-based management.

NOAA and NMFS are both pursuing ecosystem initiatives at their different levels of focus. NMFS is currently developing national Fishery Ecosystem Plan guidelines. It is unclear at this time whether these will be issued as guidelines, or as formal provisions for inclusion in the Magnuson-Stevens Act.

The Council recently reconstituted its Ecosystem Committee to discuss ecosystem initiatives and advise the Council on: (1) defining ecosystem-based management; (2) identifying the structure and Council role in potential regional ecosystem councils; (3) assessing the implications of NOAA strategic planning; (4) drafting guidelines for ecosystem-based approaches to management; (5) drafting Magnuson-Stevens Act requirements relative to ecosystem-based management; and (6) coordinating with NOAA and other initiatives regarding ecosystem-based management. In June 2005, the NPFMC requested the Ecosystem Committee to examine the development of an Aleutian Islands Fishery Ecosystem Plan, and to create an Aleutian Islands Ecosystem Plan Team. The Council also supported the committee's recommendation to explore the idea of an ecosystem council or similar regional collaboration. More details are available in the Council's June 2005 newsletter at http://www.fakr.noaa.gov/npfmc/newsletter/newsletter.htm.

At this writing, while it seems likely that changes in oceans management and associated changes in fisheries management will occur as a result of these discussions and debates, it is not clear what form these new changes will take.

3.3.2 Developments in Fisheries Rationalization

Continuing rationalization of Federal fisheries off Alaska

Comprehensive rationalization of fisheries off Alaska has long been a goal of the Council and NMFS Alaska Region. The Council and Region have pursued this goal through programs such as the license limitation program (LLP), the halibut/sablefish individual fishing quota (IFQ) program, the community development quota (CDQ) program, Crab Rationalization Program, community quota purchase programs, and fishing cooperatives. The Council's preferred alternative in the PSEIS proposes to "maintain LLP programs and modify as necessary and further decrease excess fishing capacity and overcapitalization by eliminating latent licenses and extending programs such as community or rights-based management to some or all groundfish fisheries" (NMFS 2004a).

The Council is presently considering alternative management approaches to rationalize the GOA groundfish fisheries. While the commitment to rationalization is clear, the exact form it will take has not yet been decided. Faced with changing market opportunities and stock abundance, increasing concerns about the long-term economic health of fishing dependent communities, and the fishing industry's limited ability to respond to environmental concerns under the existing management regime, the Council may consider rationalizing the fishery through individual fishing quotas, cooperatives, allocations to communities, or some combination of these. NMFS and the Council have begun the scoping process for an EIS for GOA rationalization. Information on this process is available on the web at http://www.fakr.noaa.gov/sustainablefisheries/goarat/default.htm.

While formulating a comprehensive rationalization program for all groundfish in the GOA in June 2005, the Council adopted the Rockfish Demonstration Program to stabilize the fishing community of Kodiak. The intent of the program is to improve processor stability, product quality, and market opportunities by extending the season and providing a constant flow of rockfish. Under authorizing legislation (Public Law 106-554, Section 802), the Rockfish Pilot Program is designed as a short-term, two-year program to provide economic relief until comprehensive GOA rationalization can be implemented. NMFS published a proposed rule to implement the Rockfish Pilot Program on June 7, 2006 (71 FR 33040) and anticipates implementing the Program in 2007.

In June 2006, the Council considered alternatives to rationalize the non-AFA trawl CP fleet and adopted Amendment 80. Under Amendment 80 to the BSAI Groundfish FMP, the Council recommended measures to further reduce groundfish discards and improve retention of bycatch in the non-AFA trawl CP fleet by making "specific groundfish allocations to this sector, and allowing the formation of cooperatives" (NPFMC 2005b). If approved by the Secretary, the program could be implemented by 2008.

In December 2004, the Council approved a draft problem statement and preliminary alternatives and options for a BSAI groundfish FMP amendment to review current sector allocations for Pacific cod. The Council noted in its December problem statement that the measures were needed to protect BSAI Pacific cod fishermen while incremental rationalization proceeded in other GOA and BSAI groundfish fisheries, and that allocations to the sector level are a necessary step on the path towards comprehensive rationalization. In June 2006, the Council approved Amendment 85 for sector allocations for Pacific cod. If approved by the Secretary, the new sector allocations could be effective by 2008.

The Consolidated Appropriations Act of 2005 authorizes the expenditure of up to $75 million for the buyback of CP operations in the BSAI (Public Law 108-447, Section 219). The statute allows a maximum of $36 million for the buyback of longline CPs, $6 million for AFA CPs, $31 million for non-AFA trawl CPs, and $2 million for pot CPs. It is not clear whether buyback programs will be implemented under this statute.

Rationalization should lead to fewer fishing operations that are more profitable

Past rationalization efforts in Federal waters off Alaska have led to reductions in the number of active fishing vessels. However, in past programs, the Council has also taken steps to limit the consolidation of fishing operations, and future programs are likely to place similar limits on the extent of consolidation.

Rationalization may also change the temporal and spatial distribution of fishing, by relieving fishermen from the burden of competitive derby-style fisheries, and lead to an interest in longer fishing seasons and, perhaps, changes in the location of fishing operations. Other potential environmental impacts of rationalization may come from reduced opportunity costs of changing fishing areas in response to high bycatches of non-target species, reduced gear losses, and reduced discards. On the other hand, rationalization may also lead to increased monitoring and enforcement costs in response to increased incentives to high-grade, illegally discard bycatch, and under report catches.

The operations remaining in the fishery are likely to be more profitable. Available species TACs, and their associated gross revenues, will tend to be divided among a smaller number of operations. Remaining operations will be freed, to a considerable extent, from the time pressures associated with a competitive fishery. They would have more flexibility in quality control and marketing of their products, and opportunities to arrange their fishing operations to reduce their costs. Anecdotal evidence suggests that increased profitability for remaining fishing operations appears to have been the experience in past rationalizations, including those in the halibut, sablefish, BSAI crab, and AFA pollock fisheries.

Rationalization may lead to better harvest and bycatch control

The biological impacts of a rationalized fishery depend on the specific features of the rationalization program. Theoretically, a reduction in the numbers of fishing operations, an end to derby-style fishing, and increased individual control, whether through IFQs or cooperatives, could improve in-season control over fish harvests and reduce the likelihood of a fishery exceeding specified TAC levels or seasonal apportionments of TACs. By ensuring that fishing is conducted in a more orderly manner, rationalization allows greater attention to the impacts of bycatch of non-target species, and gear interactions with seabirds and marine mammals. The extent of these improvements depends directly on the monitoring and enforcement systems enacted for the program. Evidence from previously implemented rationalization programs has tended to show practices such as high-grading, illegal discarding, and under-reporting of catches occur in many quota based programs (NMFS 2004b).

NMFS and the Council recognize the potential for misreporting and illegal fishing practices and build into rationalization programs safeguards for compliance, such as complex catch monitoring systems, VMS, adequate observer coverage, and enforcement. The Halibut/Sablefish IFQ program, AFA Pollock Cooperative Program, and the Crab Rationalization Program all contain safeguards that seek to ensure that the total weight, species composition, and catch location are reported accurately, that regulations governing the fishery are adhered to, and that there is an authoritative, timely, and unambiguous record of quota harvested (NMFS 2004b). It is reasonably foreseeable that NMFS and the Council will continue to develop rationalization programs with monitoring and enforcement safeguards.

With monitoring and enforcement safeguards, cooperatives are required to more effectively control fishery bycatch. Within the cooperative, fishermen may have the flexibility, through private contractual arrangements, to carry out bycatch control measures that would be more difficult to do purely through government measures. Fishermen have begun experimenting with bycatch control through cooperatives. Under the Chinook monitoring program in the AFA pollock fisheries, fishermen contract with each other for in-season catch monitoring by a private firm, and to abide by restrictions on fishing activity when bycatch rates rise to defined levels (NPFMC 2005a). Without monitoring and enforcement safeguards, incentives would exist for cooperatives to create mechanisms for misreporting bycatch, especially where the bycatch control measures have the potential to limit full harvest of quota species.

Rationalization of groundfish in Alaskan waters

The Alaska legislature is currently considering legislation that would give the Alaska Board of Fisheries (BOF) and the Alaska Commercial Fisheries Entry Commission (CFEC) authority to create a dedicated access privilege program for Gulf of Alaska groundfish fisheries (SB 113). The legislation has been framed to provide opportunities for the BOF and CFEC to flexibly frame programs adapted to the needs of different groundfish fisheries, and to frame them within transparent public processes. The legislation provides more flexibility than is currently offered within the State's limited entry program (ADF&G 2005).

This legislation could facilitate the coordination of rationalization in the Federal groundfish fisheries in the GOA and BSAI. State rationalization of the groundfish fisheries in State waters could occur in conjunction with, or complementary to, Federal rationalization of the Federal groundfish fisheries. The State could chose to mirror Federal rationalization for groundfish fisheries occurring inside of State waters, or to conduct completely separate fisheries with separate allocations from the Federal fisheries. Separate allocations would result in additional costs for managing a separate fishery, and many jurisdictional issues to manage and resolve.

Because this action depends on future discretionary action by the Alaska Legislature, and because of the controversy over State access limitation efforts in the past, this action is not treated as reasonably foreseeable.

Expansion of Community Participation in Rationalization Programs

Community participation in the BSAI and GOA groundfish fisheries can be expected to expand in the coming years, either through programs that directly allocate quota to communities, or through programs that allow communities to purchase quota share. These programs increase the community-based ownership of allocation privileges for the groundfish fisheries.

The Western Alaska CDQ Program allows eligible western Alaska communities to participate in the BSAI fisheries, by allocating a percentage of all BSAI quotas for groundfish, prohibited species, halibut, and crab to communities that are represented by six CDQ groups. In recent years, the Council has increased the CDQ percentage from 7.5 percent to 10 percent for the BSAI pollock and BSAI crab fisheries. Under Coast Guard and Maritime Transportation Act of 2006, with the establishment of any new rationalization program, CDQ percentage will increase to 10 percent for the fisheries under that program (Public Law 109-241). For the foreseeable future, this means that the CDQ allocation will increase under Amendment 85 for Pacific cod and Amendment 80, which creates cooperatives for the non-AFA trawl CPs.

In 2004, NMFS implemented a program to allow communities in the GOA to establish non-profit entities to purchase and hold halibut and sablefish quota share for lease to, and use by, community residents (69

FR 23681; April 30, 2004). This program was designed to further one of the Council's key objectives of the IFQ program, namely sustaining the long term retention of quota share in small, remote, and traditionally fishing dependent communities. The list of communities deemed eligible for this program was limited to smaller rural communities along the GOA shoreline without road access to larger communities (G. Merrill, pers. comm., September 2005).

Under the GOA rationalization program, the Council is considering a Community Fisheries Quota program to directly allocate quota in the GOA groundfish fisheries to eligible communities and a Community Purchase Program to allow eligible communities to purchase GOA groundfish quota share (G. Merrill, pers. comm., September 2005).

In the past, the six western Alaska CDQ groups have invested a part of their annual revenue in community-based fisheries development, as well as fishing asset acquisition. These investments have included numerous large commercial vessels, several inshore processing plants, as well as recreational charter vessels. In addition, the CDQ groups have funded water and sewer infrastructure, gear storage facilities, commercial harbor and dock construction, dredging, boat ramps, ice machines, small boat harbor facilities, processing plant upgrades, new processing plant construction, and loans to fisheries-support businesses. The CDQ groups have also provided infrastructure-matching funds, and have contracted for fisheries development services (Northern Economics 2002). An observed result of the success of community-based allocation programs has been considerable development of port, harbor, and processing infrastructure, and such development can be expected in the future.

Future expansion of community participation in rationalization programs may result in economic development similar to that brought about by the CDQ program. Any capital projects could have environmental impacts associated with shoreline development, increased offal and other waste discharge from processing activities, and disruption of benthic habitat through port development. It should be noted, however, that such development is subject to local, State, and Federal permit requirements. NMFS conducts EFH consultations on Federal projects that may adversely affect EFH and offers EFH conservation recommendations for those projects, when necessary. For example, NMFS consults on U.S. Army Corps of Engineers' Section 404 Permit Applications for development activities that may impact riparian areas, estuaries, or marine area. Such oversight potentially reduces the cumulative environmental impact of these developments.

3.3.3 Developments in traditional management tools

Authorization of groundfish fisheries in future years

The annual harvest specifications process (and the associated groundfish fisheries) creates an important class of reasonably foreseeable actions that will take place in every one of the years considered in the cumulative impacts horizon (out to, and including, 2015). Annual TAC specifications limit each year's harvest within sustainable bounds. The overall OY limits on harvests in the BSAI and in the GOA constrain overall harvest of all species.

The process by which harvest specifications are adopted, and by which in-season management takes place, is described in detail in Section 3.2 of this chapter. This process is conducted in accordance with the mandates of the Magnuson-Stevens Act, following guidelines prepared by NMFS, and in accordance with the process for determining overfishing criteria that is outlined in Section 3.2 of each of the groundfish FMPs. Specifications are developed using the most recent fishery survey data (often collected the summer before the fishery opens) and reviewed by the Council and its SSC, AP, and Plan Teams. The process provides many opportunities for public comment (see Section 1.5 of this EIS). The management process, of which the specifications are a part, is subject to a programmatic supplemental EIS finalized in 2004 (NMFS 2004a). Each year's specifications are subject to a NEPA review.

Annual target species harvests, conducted in accordance with the annual specifications, will impact the stocks of the target species themselves. Annual harvest activity may change total mortality for the stocks, may affect stock characteristics through time by selective harvesting, may affect reproductive activity, may increase the annual harvestable surplus through compensatory mechanisms, may affect the prey for the target species, and may alter EFH.

The annual target species harvests also impact the environmental components described in this EIS: non-target fish species, seabirds, marine mammals, living and non-living benthic habitat, and a more general set of ecological relationships. In general, the environmental components are renewable resources, subject to environmental fluctuations. Ongoing harvests of target species may be consistent with the sustainability of other resource components if the fisheries are associated with mortality rates that are less than or equal to the rates at which the resources can grow or reproduce themselves. On the other hand, some dimensions of the benthic habitat may constitute non-renewable and depletable resources, or resources renewable on such a long time frame that they are essentially non-renewable and depletable.

The on-going fisheries employ thousands of fishermen and fish processors, and contribute to the maintenance of human communities, principally in Alaska and the Pacific Northwest states.

Each year, OFLs, ABCs, and TACs are specified for two years at a time, as described in section 3.2. In December 2006, the Council will recommend a set of specifications for the years 2007 and 2008. The 2007 specifications adopted at that time will supersede the 2007 specifications that the Council recommend in December 2005. The new 2007 specifications will be based on survey data on fish stocks collected during the summer of 2006 and analyzed in the fall of 2006.

Increasing enforcement responsibilities

New rationalization programs and other new programs to protect resource components from groundfish fishery impacts will create additional responsibilities for enforcement agencies. Rationalization programs that assign privileges to harvest or process fish, or that create responsibilities to deliver fish to particular buyers, or to deliver fish harvested in designated zones to designated sites, create additional monitoring responsibilities for enforcement. Programs such as subsistence harvest allocations, charter halibut harvesting allocations, community quota shares, the GOA Rockfish Pilot Program, and individual and processor quota shares and cooperatives for BSAI crab, all increase enforcement responsibilities, as do programs that require the discard or retention of specific bycatch, that impose spatial or temporal closures to fishing, or that create gear or operational performance standards. New programs of these types are likely in the near future and suggest a reasonably foreseeable increase in enforcement responsibilities.

Despite this likely increase in enforcement responsibilities, it is not clear that resources for enforcement will increase proportionately. The U.S. Coast Guard (USCG) is expected to bear a heavy responsibility for homeland security and is not expected to receive proportionate increases in its budget to accommodate increased fisheries enforcement. Likewise, the NOAA Office of Law Enforcement (OLE) has not recently received increased resources consistent with its increasing enforcement obligations. (J. Passer, pers. comm., July 2006)

However, new enforcement assistance has become available in recent years through direct Congressional line item appropriations for Joint Enforcement Agreements (JEAs) with all coastal states. The State of Alaska has received a total of $6.15 million of this funding since 2001, and has used JEA money to purchase capital assets such as patrol vessels and patrol vehicles. The State has also hired new personnel to increase levels of at-sea and dockside enforcement and used JEA money to pay for support and operational expenses pertaining to this increased effort (J. Passer, pers. comm., July 2006).

Additional funding will also be generated by cost recovery programs established under § 304(d)(2) of the Magnuson-Stevens Act. NMFS is required to establish a cost recovery fee system to recover actual costs directly related to the management and enforcement of IFQ or CDQ programs. NMFS has established cost recovery fee systems for the halibut/sablefish IFQ program and the Crab Rationalization Program. Fees are paid by fishery participants and are based on the ex-vessel value of species harvested under the program. Cost recovery fees are prohibited from exceeding three percent of the annual ex-vessel value of the fisheries to which they apply. Cost recovery fee systems help ensure that funding is available to manage and enforce IFQ programs. It is reasonably foreseeable that NMFS will continue to establish cost recovery systems for IFQ programs.

Uncertainties about Congressional authorization of increased enforcement funding preclude any prediction of trends in the availability of resources to meet increased enforcement responsibilities. Thus, while an increase in responsibilities is reasonably foreseeable, a proportionate increase in funding is not.

Technical and program changes that will improve enforcement and management

It is reasonably foreseeable that managers will make increasing use of technologies for fisheries management and enforcement. Managers are likely to make increasing use of VMS in coming years. Vessels fishing for pollock, Pacific cod, and Atka mackerel, vessels operating in the Aleutian Islands, vessels operating mobile bottom contact gear in the GOA, and vessels in the crab rationalization program, are required to operate VMS units (50 CFR 679.7(a)(18)). In-season managers and enforcement personnel are making extensive use of the information from existing VMS units, and are likely to make more use of it in the future, as they continue to learn how to use it more effectively. The Council and NMFS are analyzing the possibility of extending VMS requirements in Federal waters off of Alaska.

A joint project by NMFS, the State of Alaska, and the IPHC led to electronic landings reporting for groundfish during 2006. When fish are delivered on shore, fishermen and buyers will be able to fill out a web-based form with the information on landings. The program will generate a paper form for industry and will forward the data to a central repository, where they will be available for use by authorized parties. Mandatory electronic reporting was implemented for crab fisheries in August 2005. A voluntary program for groundfish fishing operations began early in 2006 with the intent that, after a reasonable period of time, the program will become a formal requirement for groundfish deliveries. The introduction of electronic reporting will allow enforcement staff to look at large masses of data for violations and trends. The web-based input form will contain numerous automatic quality control checks to minimize data input errors. The program will get data to enforcement agents more quickly, increase the efficiency of record audits, and make enforcement activity less intrusive, as agents will have less need to board vessels to review documents onboard, or enter plants to review documents on the premises (J. Passer and D. Ackley, pers. comm., September 2005).

Although rationalization programs increase the monitoring obligations for enforcement, they also improve enforcement and management capabilities by shifting enforcement efforts from the water to dockside for monitoring landings and other records (J. Passer, pers. comm., September 2005). Moreover, by stabilizing or reducing the number of operations and by creating fishing and processing cooperatives, rationalization reduces the costs of private and joint action by industry to address certain management issues, particularly the monitoring and control of bycatch. For example, as noted earlier, in the salmon bycatch monitoring program in the AFA pollock fisheries of the BSAI, fishermen contract together for in-season catch monitoring by a private firm, and agree to restrict fishing activity when bycatch rates rise to defined levels. In the scallop fleet, some members have formed a cooperative which requires members not to exceed crab bycatch limits. Exceeding limits may result in monetary or other punitive action against a member, thereby reducing bycatch of non-target species in the scallop fishery (N. Sagalkin, pers. comm., September 27, 2005).

The Council took action to extend into the foreseeable future the current observer program, which was set to expire in December 2007. At the same time, the Council and NMFS are analyzing options for restructuring the North Pacific Groundfish Observer Program. The analysis examines alternatives for a new system for procuring and deploying observers in the groundfish and halibut fisheries of the North Pacific. All of the action alternatives would wholly or partially replace the current pay-as-you-go system (where vessels contract directly with observer providers to meet coverage levels specified in regulation) with a program supported by broad-based user fees and/or direct Federal subsidies, in which NMFS would contract directly for observer coverage and be responsible for determining when and where observers should be deployed. Under this new program, vessel operators in fisheries with less than 100 percent coverage would no longer be responsible for obtaining certain levels of observer coverage specified in regulation, but instead, would be required to carry observers when directed by NMFS or NMFS contracted observer provider. Vessels and processors in fisheries that require 100 percent or 200 percent coverage would continue to operate much as they do today, except that NMFS would be responsible for observer procurement, rather than the fishing companies themselves (J. Anderson, pers. comm., September 27, 2005). Pending Council action, however, it is premature to describe this as a reasonably foreseeable action. If implemented, such a program would contribute to the overall quality of observer data to support scientific and management data needs.

NMFS has begun to implement the use of ship board video monitoring to ensure compliance with full retention requirements in other Regions. In the Alaska Region, NMFS is investigating the use of video to monitor discards and catch sorting actions. NMFS is hopeful that these investigations could lead to regulations that allow use of video monitoring to supplement observer coverage in some fisheries. Electronic monitoring technology is evolving rapidly, and it is probable that video and other technologies will be introduced to supplement current observer coverage and enhance data collection in some fisheries. These technologies are not sufficiently developed for this use at this time (A. Kinsolving, pers. comm., September 27, 2005).

3.3.4 Actions by Other Federal, State, and International Agencies

Future exploration and development of offshore mineral resources

The Minerals Management Service (MMS) expects that reasonably foreseeable future activities include numerous discoveries that oil companies may begin to develop in the next 15-20 years in Federal waters off Alaska. In the near future, the OCS (Outer Continental Shelf) Leasing Program will be offering two sales of about 2.5 million acres in the Cook Inlet/Shelikof Straits region in 2006 and 2007. The current MMS 5-year management plan includes authorizing leases in the Chukchi and Beaufort Seas, and Cook Inlet. The latest Cook Inlet lease sale received no bids, so the sale was not held. There is a possibility that they will again offer the lease up for sale in 2006. Potential environmental risks from the development of offshore drilling include the impacts of increased vessel offshore oil spills, drilling discharges, offshore construction activities, and seismic surveys. In an EIS prepared for upcoming sales in the OCS Leasing Program, the MMS has assessed the cumulative impacts of such activities on fisheries and finds only small incremental increases in impacts of development, unlikely to significantly impact fisheries and essential fish habitat (MMS 2003).

Reductions in United States Coast Guard fisheries enforcement activities

The USCG conducts fisheries enforcement activities in the EEZ off Alaska in cooperation with NOAA OLE. Increased responsibilities for homeland security and for detection of increasing drug-smuggling activities in waters off Alaska have limited the resources available for the USCG to conduct enforcement activities at the same level as in the recent past. Any deterrent created by Coast Guard presence in enforcing fisheries regulations and restrictions would likely be reduced, as would the opportunities for detection of fisheries violations at-sea. Council consideration of expanded VMS requirements would mitigate the increasingly limited USCG resources by providing immediate real-time knowledge of a vessel's location. (Commander M. Cerne, pers. comm., September 2005). For additional information, see Section 3.3.3 Developments in traditional management tools.

Continuing oversight of seabirds and some marine mammal species by the U.S. Fish and Wildlife Service

The USFWS is the lead agency for managing and conserving seabirds and certain marine mammal species, and for administering the ESA. Under its responsibilities for the ESA, the USFWS has changed the status of two species since 2002: the northern sea otter has been listed as threatened (70 FR 46366; August 9, 2005), and Kittlitz's murrelet has been made a candidate for listing (69 FR 24876; May 4, 2004). The status of these two species, while having no effect at present, may in the future require additional action to protect these species and their critical habitat from adverse impacts.

Expansion and Construction of Boat Harbors by U. S. Army Corps of Engineers, Alaska District, Civil Works Division (COE-CW)

COE-CW funds harbor developments, constructs new harbors, and upgrades existing harbors to meet the demands of fishing communities. Several upgraded harbors have been completed to accommodate the growing needs of fishing communities and the off-season storage of vessels. Local storage reduces transit times of participating vessels from other major ports, such as Seattle, Washington. Upgraded harbors include, King Cove, Dutch Harbor, Sand Point, Seward, Port Lions, Dillingham, and Kodiak. Additionally, new harbors are planned for Akutan, False Pass, Tatitlek, and Valdez.

Expansion of State groundfish fisheries

The State of Alaska may expand State-managed or State parallel groundfish fisheries. The State manages fisheries in waters 0 nm to 3 nm from shore. These State-waters fisheries may be managed either concurrent with the Federal fisheries (parallel) with the same species, time, gear and area restrictions or independent of the Federal fisheries (State-managed fisheries). Typically, the State sets the fishery quotas and opens State-managed fisheries after Federal fisheries conclude in adjacent waters. State parallel fisheries occur in State waters but are opened at the same time as Federal fisheries in the EEZ. State parallel fisheries harvests are managed against the Federal TAC, and vessels move between State and Federal waters during the concurrent State parallel and Federal fisheries.

State-managed fisheries are controlled by a GHL which is tracked by the State. The Federal TAC for GOA Pacific cod is reduced by the amount needed for the State's GHL for Pacific cod to prevent overfishing. Currently, State-managed GOA Pacific cod fisheries inside 3 nm are allocated up to 25 percent of the Federal TAC in each corresponding management area. The BOF has received numerous petitions from participating fishermen to increase this percentage, but has tabled any action pending federal action towards GOA groundfish rationalization. If the State increases the quotas for the State-managed Pacific cod fishery, some accommodation may be made by reducing the Federal TAC to ensure total harvests of the stock do not exceed the ABC.

The BOF has received petitions to modify the management of the pollock and Pacific cod fisheries near Adak Island, Cook Inlet, and western GOA. The petitions may be viewed at http://www.boards.adfg.state.ak.us/fishinfo/meetinfo/2006_2007/bof-prop06-07.pdf. The BOF will review and decide on the next course of action for each petition for the Pacific cod and pollock in the Adak Island and Cook Inlet areas in October 2006 and for the western GOA Pacific cod fisheries in February 2007. In the western GOA, petitioners request establishing a State waters pollock fishery based on at least 15 percent of the Federal TAC and limited to vessels less than 58 feet length overall. Petitions regarding the Pacific cod fishery in the western GOA include establishing the GHL as half of the Federal TAC and adjusting closures, vessel participation, and reporting to improve management. The Pacific cod and 15 percent pollock GHL petitions are presented for the first time to the BOF in October 2006, and February 2007, and are likely to need additional consideration before implementing.

The ADF&G, on behalf of the BOF, has petitioned to establish a State-waters pollock fishery in the Adak area and in the Cook Inlet area with options for limits on locations, harvest amounts and vessel size. These petitions were deferred during the BOF meetings in March and October 2005 and may be acted on in the October 2006 meeting. In both petitions, portions of Steller sea lion protection areas currently closed to a Federal pollock fishing may be opened in the State-waters pollock fishery.

Because most of the 0 nm to 3 nm waters are designated as critical habitat for Steller sea lions, potential changes in State fisheries are monitored closely with regards to changing distributions of prey species and effort. Any petition related to Pacific cod and pollock fisheries that would be different from the Steller sea lion protection measures needs to be reviewed by NMFS to determine if the action would result in formal consultation under the ESA based on a change in the federal action (in the case of the parallel fishery) or based on new information (in the case of the State-managed fishery). A formal consultation would result in a BiOp. If a new BiOp found that the action is likely to result in jeopardy or adverse modification of critical habitat, reasonable and prudent alternatives for the Federal fishery may be required to minimize impacts from the State-waters fishery. Any significant change in the State-managed or State parallel Pacific cod or pollock fisheries likely would result in changes to the Federal fisheries to minimize the impacts of the State fisheries on the fish stocks and on Steller sea lions. Any changes in the Federal fishery would depend on the potential impacts of the State fisheries.

Given the uncertainty about the possibility of State action, its timing, and the form it might take, the petitions to the BOF cannot be considered reasonably foreseeable future actions at this time.

Other State of Alaska actions

Several State actions in development may impact habitat and those animals that depend on the habitat. These potential actions will be tracked, but cannot be considered reasonably foreseeable future actions because the State has not proposed regulations. These actions include:

- Amendments to the Alaska Coastal Zone Management Program (ACMP). Program changes have been submitted to NOAA for review. NOAA is developing an EIS to determine whether to support the decision for approval. The State would need to propose regulations after receiving approval. Proposed changes under consideration include revisions to State standards for coastal development, energy facilities, utility routes and facilities, sand and gravel mining and mineral processing, transportation routes and facilities, and subsistence uses; the establishment of automatic consistency for shallow gas exploration and development projects; the habitat policy; the scope and content of District Plans; and the Department of Environmental Conservation (DEC) "Carve Out" resulting in direct issuance by DEC of air and water quality permits without ACMP review.

- Changes to the residue criteria under the Alaska Water Quality Standards. The State proposes to significantly generalize the language of the residues criterion and increase discretion in determining what constitutes an exceedance. DEC's proposed residues criterion eliminates the prohibition for residues to cause leaching of toxic or deleterious substances. Under the new system, any and all residue discharges would be allowed without a permit, unless some type of harm (objectionable characteristics or presence of nuisance species) is discovered. EPA has provided comments to the State regarding this proposed change and determined that major changes were needed for EPA approval.

- The State has passed legislation to implement State primacy for the National Pollution Discharge Elimination System Program under the Clean Water Act and has submitted a primacy package to EPA. The program is required to be as stringent as the current federal program but the effectiveness of implementation will be the key to whether impacts on habitat may be seen.

NMFS staff will track the progress of these potential actions and will include these in effects analyses in future NEPA documents when proposed rules are issued.

Ongoing EPA monitoring of seafood processor effluent discharges

In Alaska, the EPA currently administers National Pollutant Discharge Elimination System (NPDES) permits to control discharge at shore-based seafood processing facilities. These permits involve effluent, or end-of-pipe, limitations for Alaska seafood processors. With the development of the pollock fisheries, NPDES permits were issued in 1991 and 1996 to require one mm screening of fish wastes and reduction of those wastes to fish meal, significantly reducing in the amount of solids discharged from these facilities. NPDES permits provided technology-based effluent limitations for finfish and fish meal processing and required annual surveys of dissolved oxygen and waste piles in the receiving water. Expired NPDES permits may be supplemented with Total Maximum Daily Load (TMDL) plans and explicit limits of the wasteloads of biological oxygen demand and settleable solid waste residues. A TMDL identifies levels of pollution control needed to achieve water quality standards. The TMDL needs to consider all sources, point, nonpoint, and background, in determining the loading capacity of a body of water. The plan identifies preventative and remedial actions which will reduce pollutant loads to water quality-limited waterbodies. It is reasonable to assume that in the foreseeable future, the EPA will continue to require seafood processors to monitor and limit discharge of waste into coastal waters.

3.3.5 Private actions

Commercial fishing

Fishermen will continue to fish for groundfish and other species as authorized by the Council, NMFS, the State, and the IPHC. This fishing constitutes the most important class of reasonably foreseeable future private actions. Additional groundfish fisheries will take place indefinitely into the future. For analytical purposes, this document considers impacts though 2015.

In 2004, 913 catcher vessels fished part of Federal TACs off of Alaska; 633 used hook-and-line gear, 199 used pot gear, and 151 used trawl gear. That same year, 83 catcher-processors operated off of Alaska; 41 of these used hook-and-line gear, 4 used pot gear, and 40 used trawl gear (Hiatt, 2004). As noted in the section on rationalization, rationalization programs can reasonably be expected to reduce the total number of fishing operations in Federal waters off of Alaska in coming years.

The Marine Stewardship Council (MSC) is a non-profit organization that seeks to promote the sustainability of fishery resources through a program of certifying fisheries that are well managed with respect to environmental impacts (MSC web page at http://eng.msc.org/). Certification conveys an advantage to industry in the market place, by making products more attractive to consumers who are sensitive to environmental concerns. A fishery must undergo a rigorous review of its environmental impact to achieve certification. Fisheries are evaluated with respect to the potential for overfishing or recovery of target stocks, the potential for the impacts on the "structure, productivity, function and diversity of the ecosystem," and the extent to which fishery management respects laws and standards, and mandates "responsible and sustainable" use of the resource. (SCS 2004) Once certified, fisheries are subject to ongoing monitoring, and requirements for recertification.

The MSC has certified the BSAI and GOA pollock, BSAI Pacific cod freezer longline, halibut, and sablefish fisheries. Because the program requires ongoing monitoring and re-evaluation for certification every five years (SCS 2004), and because the program may convey a marketing advantage, MSC certification may change the industry incentive structure to increase sensitivity to environmental impacts. This certification currently may only affect the incentives for the certified fisheries. Certification of other groundfish fisheries cannot currently be considered reasonably foreseeable.

Increasing levels of economic activity in Alaska's waters and coastal zone

Alaska's population has grown by over 100,000 persons since 1990 (U.S. Census Bureau web page accessed at http://www.census.gov/ on July 14, 2005). As of June 2005, Alaska's estimate population is about 662,000. The Alaska State Demographer's projection for the end of the forecast period of this analysis (2015) is about 734,000, an 11 percent increase (Williams 2005). In Alaska, the success of the CDQ program and the expansion of such community based allocation programs in the future (as discussed under the earlier section on reasonably foreseeable rationalization programs) may lead to increased population in affected communities.

A growing population will create a larger environmental "footprint," and increase the demand for marine environmental services. A larger population will be associated with more economic activity from increased cargo traffic from other states, more recreational traffic, potential development of lands along the margin of the marine waters, increased waste disposal requirements, and increased demand for recreational fishing opportunities.

Alaska's population has also grown, and is expected to continue to grow, in its coastal regions (Crossett et al. 2004). Population growth in these regions may have larger impacts on groundfish stocks than growth in inland areas. So far, Alaska's total population growth in coastal areas remains low compared to that in other states. Alaska had the second largest percentage change in growth over the period from 1980 to 2002, but this percent was calculated from a relatively low base. Its coastal population grew by about 63 percent. Alaska has the smallest coastal population density of all the states, with an average of 1.4 persons per square mile in 2003. By comparison, coastal densities were 641 persons per square mile in the northeastern states, 224 on the Atlantic southeastern states, 164 along the Gulf of Mexico, 299 along the West Coast exclusive of Alaska, and 238 in the Great Lakes states (including New York's Great Lakes counties). Maine and Georgia, the states with the next lowest coastal population density, had 60 persons per square mile (Crossett et al. 2004). Crossett et al. project continued population growth in Alaska's coastal regions; however growth in these areas will never approach the levels seen in Hawaii and the lower 48 states.

Shipping routes from Pacific Northwest ports to Asia run across the GOA and through the BSAI, and pass near or through important fishing areas. The key transportation route from West Coast ports in

Washington, Oregon, and British Columbia to East Asia (and back) passes from the GOA into the EBS at Unimak Pass, and then returns to the Pacific Ocean in the area of Buldir Island. A minimum estimate is that 2,700 large vessels use this route each year.[9] The direct routes from California ports to East Asia pass just south of the Aleutian Islands. Continued globalization, growth of the Chinese economy, and associated growth in other parts of the Far East may lead to increasing volumes of commercial cargo vessel traffic through Alaska waters. U.S. agricultural exports to China, for example, doubled between 2002, and 2004; 41 percent of the increase, by value, was soybeans and 13 percent was wheat (USDA 2005). In future years, this may be an important route for Canadian oil exports to China (Zweig and Jianhai 2005).

The significance of this traffic for the regional environment and for fisheries is highlighted by recent shipping accidents, including the December 2004 grounding of the M/V Selendang Ayu and the July 2006 incapacitation of the M/V Cougar Ace. The Selendang Ayu dumped the vessel's cargo of soybeans and as much as 320,000 gallons of bunker oil, on the shores of Unalaska Island (USCG, Selendang Ayu grounding Unified Command press release, April 23, 2005). On July 23, the M/V Cougar Ace, a 654-foot car carrier homeported in Singapore, contacted the US Coast Guard and reported that their vessel was listing at 80 degrees and taking on water. The Alaska Air National Guard and Coast Guard aircraft crews rescued the 23 crewmembers on July 24 (Unified Command website, August 8, 2006, http://www.dec.state.ak.us/spar/perp/response/sum_fy07/060728201/060728201_index.htm).

Mining activities in Alaska are expected to increase in the coming years. In Southeast Alaska, the Kensington mine in Berners Bay is under construction and the Goldbelt mine at Hawk Inlet is slated for expansion. The Red Dog mine in Northwest Alaska will continue operations and a new deposit in the Bristol Bay region is being explored for possible large-scale strip mining. The continued development and/or expansion of mines, though expected, will be dependent on stable metals prices in the coming years. At present it appears such prices will be stable (S. Miller, pers. comm., September 2005)

Oil and gas development can also be expected to increase due to the currently high oil and gasoline prices. Plans are underway for development of a gas pipeline that may include a shipping segment through the GOA. Exploration and eventual extraction development of the Arctic National Wildlife Preserve is also anticipated. It is also possible that fuel prices may create incentive for oil and gas lease sales on the continental shelf off Western Alaska, which is the prime fishing ground of the EBS (S. Miller, pers. comm., September 2005)

Expansion of Aquaculture

On a national level, NMFS is working towards well-managed, environmentally-sound, and productive marine aquaculture operations by developing new offshore aquaculture legislation for the EEZ. NMFS plans to develop this legislation over the next five years to establish a fully operational regulatory infrastructure for offshore aquaculture that includes a streamlined permitting process, citing criteria, and pre-approved zones for offshore aquaculture (NMFS 2005b). With this national priority for aquaculture development, it is reasonably foreseeable that aquaculture will increase in the next 10 years.
In the near future, sablefish is the groundfish species most likely to become an aquaculture product. The relatively high value of sablefish has prompted research and development into sablefish aquaculture. If sablefish aquaculture becomes commercially viable, increased sablefish supply could cause a drop in sablefish prices (e.g., as salmon aquaculture has impacted wild salmon prices). Available research indicates that sablefish aquaculture production of 30,000 metric tons, which is similar to current world

[9] Based on estimates of vessels transiting Unimak Pass provided by the U.S. Coast Guard maritime Domain Awareness Center in 2004. More recent information suggests that the actual number of vessels transiting the Pass may be two or three times as large as this. (T. Robertson, pers. comm.).

wild production, would reduce sablefish ex-vessel prices by 37 percent (Huppert & Best 2004). Such a change would have direct impact on revenue earned by sablefish harvesters and may reduce effort in wild sablefish fisheries. This might reduce the benefits from IFQ and CDQ sablefish programs. In addition, the aquaculture industry could create environmental externalities from parasites, disease, escape, and pollution. A recent study by the Fisheries Center of the University of British Columbia concluded that, when the environmental externalities are considered, large-scale sablefish aquaculture would not be beneficial to the British Columbia economy (Sumalia et al. 2005).

Currently NMFS is unaware of plans for sablefish, or other finfish, aquaculture in Federal waters off of Alaska. The State of Alaska encourages shellfish aquaculture, but not finfish aquaculture (K. Miller, pers. comm., December 16, 2005). Therefore, while price impacts could have an indirect environmental impact in the action area, by reducing incentives to fish for some species of groundfish, there appears to be little likelihood of a more direct environmental impact.

3.4 Species listed under the Endangered Species Act

Twenty-one species occurring in the action area are currently listed as endangered, threatened, or candidate species under the ESA (Table 3-2). The group includes seven species of great whales, one pinniped, four Pacific salmon, three seabirds, one albatross, four sea turtles, and sea otters. These listed species may be affected by the proposed action.

With some exceptions, NMFS oversees marine mammal species, marine and anadromous fish species, and marine plant species. USFWS oversees walrus, sea otter, seabird species, and terrestrial and freshwater wildlife and plant species. Federal actions must be in compliance with the provisions of the ESA. Section 7 of the ESA provides a mechanism for consultation by the Federal action agency with the appropriate expert agency (NMFS or USFWS). NMFS Sustainable Fisheries Division consults on fisheries management actions that may affect marine mammals with NMFS Protected Resources Division. For fisheries management actions that may affect seabirds, NMFS consults with USFWS.

Informal consultations, resulting in letters of concurrence, are conducted for Federal actions that have no adverse affects on the listed species. The action agency can prepare a BA to determine if the proposed action would adversely affect listed species or modify critical habitat. The BA contains an analysis based on biological studies of the likely effects of the action on the species or habitat.

Formal consultations, resulting in BiOps, are conducted for Federal actions that may have an adverse affect on the listed species. Through the BiOp, a determination is made about whether the proposed action poses “jeopardy” or “no jeopardy” of extinction to the listed species.

Summaries of the ESA consultations before 2004 on individual listed species are located in the Section 3.0 of the PSEIS and its accompanying tables, under each ESA listed species’ management overview (NMFS 2004a).

The effects of the groundfish fisheries on ESA listed marine mammals are discussed in Chapter 8. An FMP level Section 7 consultation BiOp was completed for the groundfish fisheries in November 2000 (NMFS 2000) for listed species managed by NMFS. This BiOp covers marine mammals, turtles, and Pacific salmon. In the BiOp, the western distinct population segment of Steller sea lions was the only ESA-listed species identified as likely to experience jeopardy of extinction or adverse modification of designated critical habitat from the effects of the groundfish fisheries.

NMFS and the Council developed Steller sea lion protection measures for the groundfish fisheries to minimize the effects of the fisheries on Steller sea lions and their critical habitat. A subsequent BiOp on the Steller sea lion protection measures was issued in 2001 (NMFS 2001, appendix A, supplement 2003). The 2001 BiOp found that the groundfish fisheries conducted in accordance with the Steller sea lion protection measures were unlikely to cause jeopardy of extinction or adverse modification or destruction of critical habitat for Steller sea lions.

On October 18, 2005, the Council requested that NMFS reinitiate consultation on the November 2000 BiOp and evaluate all new information that has developed since the previous consultations. New information would be useful as the Council considers potential changes to the Steller sea lion protection measures implemented in the fisheries. NMFS SFD requested reinitiation of Section 7 consultation on April 19, 2006 and provided a BA to the PRD (NMFS 2006a). The BA analyzes the effects of the groundfish fisheries on ESA-listed marine mammals and sea turtles under NMFS jurisdiction. The only species that were determine to be likely to be adversely affected by the groundfish fisheries were Steller sea lion, humpback whales, and sperm whales. The draft BiOp is expected to be available in late 2006.

The effects of the groundfish fisheries on ESA-listed salmon are discussed in Chapter 7. The incidental take statement (ITS) of 55,000 Chinook salmon from the 1999 BiOp (NMFS 1999) was exceeded in the 2004, 2005 and 2006 BSAI groundfish fisheries. NMFS Alaska Region is continuing consultation with NMFS Northwest Region to determine if the exceedence of the ITS is likely to adversely affect ESA-listed salmon. The Region is continuing to track salmon research efforts and Council activities to reduce salmon bycatch (Lohn 2005). The NMFS Northwest Region determined that the current ITS continues to exempt the BSAI fisheries from ESA Section 9 take prohibitions (Lohn 2005). On June 2, 2006, NMFS Alaska Region SFD provided to the NMFS Northwest Region a BA of the effects of the Alaska groundfish fisheries on ESA-listed salmon and steelhead (NMFS 2006b). Based on coded-wire tag recovery analysis, the Alaska groundfish fisheries were not likely to adversely affect or had no effect most ESA-listed salmon or steelhead species, except Lower Columbia River and Upper Willamette River Chinook salmon stocks. A BiOp is scheduled for completion in late 2006.

In 2006, NMFS completed an informal Section 7 consultation with the USFWS regarding northern sea otters and the Alaska groundfish fisheries. The consultation concluded that any adverse effects that the fisheries may pose involving incidental take or chronic oiling were likely discountable because of the rarity of occurrence (Mecum 2006).

The effects of the groundfish fisheries on ESA-listed seabirds are discussed in Chapter 9. Listed seabirds are under the jurisdiction of the USFWS, which has completed an FMP level (USFWS 2003a) and project level BiOps for the groundfish fisheries (USFWS 2003b). Both USFWS BiOps concluded that the groundfish fisheries and the annual setting of harvest specifications were unlikely to cause the jeopardy of extinction or adverse modification or destruction of critical habitat for ESA-listed seabirds.

The potential effects of the groundfish fisheries on ESA-listed turtles are detailed in the most recent BA (NMFS 2006a). The BA determined that the occurrence of sea turtles in the action area is very rare, and no history of groundfish interaction with sea turtles exists. The consultation determined that the groundfish fisheries were not likely to adversely affect sea turtles. Because no additional information is available, no additional analysis for sea turtles will be provided in this document. The reader should refer to the BA for the latest information on the occurrence of sea turtles in Alaska waters (NMFS 2006a).

Table 3-2 ESA listed and candidate species that range into the BSAI and GOA groundfish management areas.

Common Name	Scientific Name	ESA Status
Blue Whale	*Balaenoptera musculus*	Endangered
Bowhead Whale	*Balaena mysticetus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Right Whale[1]	*Balaena glacialis*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Steller Sea Lion (Western Population)	*Eumetopias jubatus*	Endangered
Steller Sea Lion (Eastern Population)	*Eumetopias jubatus*	Threatened
Chinook Salmon (Lower Columbia R.)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Upper Columbia R. Spring)	*Oncorhynchus tshawytscha*	Endangered
Chinook Salmon (Upper Willamette)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Snake River spring/summer)	*Oncorhynchus tshawytscha*	Threatened
Chum Salmon (Hood Canal Summer run)	*Oncorhynchus keta*	Threatened
Coho Salmon (Lower Columbia R.)	*Oncorhynchus kisutch*	Threatened
Steelhead (Snake River Basin)	*Oncorhynchus mykiss*	Threatened
Steller's Eider [2]	*Polysticta stelleri*	Threatened
Short-tailed Albatross [2]	*Phoebaotria albatrus*	Endangered
Spectacled Eider[2]	*Somateria fishcheri*	Threatened
Kittlitz's Murrelet[2]	*Brachyramphus brevirostris*	Candidate
Northern Sea Otter	*Enhydra lutris*	Threatened
Olive Ridley turtle	*Lepidochelys olivacea*	Threatened/Endangered
Loggerhead turtle	*Caretta caretta*	Threatened
Green turtle	*Chelonia mydas*	Threatened/Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered

[1]NMFS designated critical habitat for the northern right whale on July 6, 2006 (71 FR 38277).

[2] The Steller's eider, short-tailed albatross, spectacled eider, and Northern sea otter are species under the jurisdiction of the USFWS. For the bird species, critical habitat has been established for the Steller's eider (66 FR 8850, February 2, 2001) and for the spectacled eider (66 FR 9146, February 6, 2001). The Kittlitz's murrelet has been proposed as a candidate species by the USFWS (69 FR 24875, May 4, 2004).

3.5 Regime Shift Considerations

The action area for the harvest strategies is subject to periodic climatic and ecological "regime shifts." These shifts change the values of key parameters of ecosystem relationships, and can lead to changes in the relative success of different species.

Regime shifts are natural phenomena, and are not the results of human actions, at least in an obvious way. Neither are they predictable, or reasonably foreseeable. For these reasons, they have not been considered reasonably foreseeable future actions. However, because they may have important implications for future human actions in the GOA and BSAI, the following discussion of these phenomena, from the Ecosystem Considerations chapter of the 2005 SAFE (Boldt) is excerpted here.

North Pacific

In the past three decades the North Pacific climate system experienced one major and two minor regime shifts. A major transformation, or regime shift, occurred in atmospheric and oceanic conditions around 1977, part of the Pacific Decadal Oscillation (PDO), which represents the leading mode of North Pacific sea surface temperature (SST) variability and is related to the strength of the Aleutian low. The first of the minor shifts occurred in 1989, primarily in the winter PDO index. The second minor shift was in 1998, and was associated with a change in the sign of the second principal mode of North Pacific SST variability, the so-called Victoria pattern, in winter and the summer PDO index. The atmospheric expression of the Victoria pattern is a north-south pressure dipole, with the negative 500-hPa height anomaly center over the eastern Aleutian Islands and the positive center over the east-central North Pacific (positive mode of the pattern). During the period 1989-1997, atmospheric pressure tended to be above normal in the high latitudes and below normal in the mid-latitudes, which translated to a relative cooling in the Bering Sea. Since 1998, the polarity of the winter north-south pressure dipole reversed. The SST field in the eastern Bering Sea became anomalously warm, whereas colder-than-normal conditions were established along the U.S. West Coast. During the summer season, the 1998 shift exhibited itself in a transition from the north-south pressure dipole to a monopole characteristic of the negative PDO pattern. In 2003 and 2004, however, the summer and winter PDO indices became positive. During the winter of 2003, the SST anomaly pattern in the North Pacific resembled neither the PDO, nor the Victoria patterns. Winter temperatures were above the 1971-2000 average in the Bering Sea and near the average in the Gulf of Alaska and the U.S. West Coast. El Niños were present in both the winters of 2003-2004 and 2004-2005. The increase in SST along the coast of South America which is associated with El Niños, was brief, and conditions returned to neutral in July.

Bering Sea

The major shift in the BS occurred after 1977, when conditions changed from a predominantly cold Arctic climate to a warmer subarctic maritime climate. The very warm winters of the late 1970s and 1980s were followed by cooler winters in the 1990s. This cooling was likely a result of a shift in the Arctic Oscillation and hence a tendency for higher sea-level pressure (SLP) over the Bering Sea. Since 1998, negative SLP anomalies have prevailed, which is indicative of greater Pacific influence and consistent with generally milder winters. The anomalously warm winter of 2005 follows similarly warm winters of 2003 and 2004. This warming becomes comparable in its scale with major warm episodes in the late 1930s and late 1970s – early 1980s. The spring transition is occurring earlier, and the number of days with ice cover after March 15 has a significant downward trend. In 2005, the ice cover index reached the record low value. The lack of ice cover over the southeastern shelf during recent winters resulted in significantly higher heat content in the water column. Sea surface temperature in May 2005 was above its long-term average value, which means that the summer bottom temperatures also will likely be above average.

Aleutian Islands

Climatic conditions vary between the east and west Aleutian Islands around 170° W: to the west there is a long term cooling trend in winter while to the east conditions change with the PDO. This is also near the first major pass between the Pacific and Bering Seas for currents coming from the east.

Gulf of Alaska

Evidence suggests there were climate regime shifts in 1977, 1989, and 1998 in the North Pacific. Ecosystem responses to these shifts in the GOA were strong after the 1977 shift, but weaker after the 1989 and 1998 shifts. Variation in the strength of responses to climate shifts may be due to the geographical location of the GOA in relation to the spatial pattern of climate variability in the North Pacific. Prior to 1989, climate forcing varied in an east-west pattern, and the GOA was exposed to extremes in this forcing. After 1989, climate forcing varied in a north-south pattern, with the GOA as a transition zone between the extremes in this forcing. The 1989 and 1998 regime shifts did not, therefore, result in strong signals in the GOA.

There were both physical and biological responses to all regime shifts in the GOA; however, the primary reorganization of the GOA ecosystem occurred after the 1977 shift. After 1977, the Aleutian Low intensified resulting in a stronger Alaska current, warmer water temperatures, increased coastal rain, and, therefore, increased water column stability. The optimal stability window hypothesis suggests that water column stability is the limiting factor for primary production in the GOA. After 1989 water temperatures were cooler and more variable in the coastal GOA, suggesting production may have been lower and more variable. After the 1998 regime shift, increased storm intensity from 1999 to 2001 resulted in a deeper mixed layer depth in the central GOA, and winter coastal temperatures were average or slightly below average. Initial data from the NMFS summer bottom trawl survey indicate that 2005 sea surface temperatures in eastern GOA were very warm.

Predictions

It has been shown that the North Pacific atmosphere-ocean system included anomalies during the winter of 2004-05 that were unlike those associated with the primary modes of past variability. This result suggests a combination of two factors: (1) that the nature of North Pacific variability is actually richer in variability than appreciated previously, and (2) that there is the potential for significant evolution in the patterns of variability due to both random, stochastic effects and systematic trends such as global warming. Notably, at the time of this writing, it cannot be determined whether the North Pacific is heading into a positive PDO-like condition or some other state. The Bering Sea shows three multidecadal regimes in SAT fluctuations: 1921-1939 (warm), 1940-1976 (cold), and 1977-2005 (warm). It is worth noting that the two previous regimes had a similar pattern, when SAT anomalies were strongest at the end of the regime, right before the system switched to a new one. In the current warm regime, the magnitude of SAT fluctuations has been steadily increasing since the mid-1980s, and the Bering Sea may become even warmer before it will switch to a new cold regime. If the regime concept is true, this switch may happen anytime soon, especially given the uncertain state of the North Pacific climate, suggesting that it may be in a transition phase. It is unknown if changes observed after the 1998 shift will persist in the Gulf of Alaska and how long the current conditions in the Gulf of Alaska will last.

Predicting regime shifts will be difficult until the mechanisms that cause the shifts are understood. It will require better understanding of the probability of certain climate states in the near-term and longer term and the effects of this variability on individual species production and distribution and food webs. Future ecosystem assessments may integrate various climate scenarios into the multispecies and ecosystem forecasting models by using assumptions about the effects of climate on average recruitment of target species.

Warming and loss of sea ice in the Bering Sea

There have been three multidecadal regimes in surface air temperatures in the North Pacific: 1921-1939 (warm), 1940-1976 (cold), and 1977-2005 (warm; Rodionov et al. 2005). Depth-integrated temperatures in the southeast Bering Sea indicate that there was a shift to even warmer conditions in the Bering Sea that began in the spring of 2000 (Rodionov et al. 2005). During the last three decades there has been a marked decrease in ice extent, duration and concentration over the southeastern Bering Sea (Stabeno et al. 2006).

Stabeno (et al. 2006) state that "The decrease in sea ice directly impacts water column temperature and salinity…. The average temperature at M2 [Mooring 2 located in the southeast Bering Sea] has increased by ~3°C over the last decade, with warmer temperatures in both winter and summer. Ocean temperatures have profound influences on the distribution of many species in the eastern Bering Sea" as well as the timing of the spring transition, which is occurring earlier (Rodionov et al. 2005). Stabeno (et al. 2006) also state: "The sea ice over the shelf also determines the timing and nature of the spring phytoplankton bloom (Stabeno et al. 1998; Stabeno et al. 2001; Hunt et al. 2002)…Recent observations [also] indicate a disappearance in the southeast [Bering Sea] of cold water invertebrate species which were previously common (e.g. *Calanus marshallae*; *Themisto libulella*, *Chionoecetes opilio*)….populations of smaller copepods such as Pseudocalanus spp., which are much more numerous, may be much more productive in the warmer years (Coyle and Pinchuk 2002). Thus the direction of climate change affects different components of the ecosystem in different ways and will affect the transfer of energy through the food web."

"The distributions of adult and juvenile fish…respond to water temperatures. For example, the distribution of species such as Arctic cod that prefer cold temperatures may be retreating to the northern portion of the Bering Sea. On the other hand, Walleye pollock (*Theragra chalcogramma*) tend to avoid water below 2°C (e.g. Wyllie-Echeverria 1995, Overland and Stabeno 2004), and the disappearance of the summer cold pool over the shelf may result in the distribution of pollock extending further north." Spencer (2005) has shown rock sole and flathead sole are distributed further north or northwest in warm years relative to cold years.

The Bering Sea Interagency Working Group (2006) states "Changes in the finfish and shellfish communities have occurred since the 1980s, but these have included both increases and decreases in overall abundance and changes in species composition. Walleye pollock and Pacific cod abundances have fluctuated but remain at high levels. Flatfish, as an assemblage, are at high levels, but individual species have changed their relative importance (e.g., Greenland turbot has decreased in importance and arrowtooth flounder has increased). Recruitment of sockeye salmon stocks has been strong with the exception of the Kvichak run; some runs of chinook and chum salmon have shown reduced recruitment in the Yukon and Kuskokwim Rivers (Kruse 1998). Crabs, in particular, are at low levels relative to their peak in biomass in the late 1980s/ early 1990s, and all Bering Sea stocks are considered overfished. Snow crab, the dominant species, has been decreasing, and there is evidence that populations may be retreating to the north with the cold bottom water (Orensanz et al. 2004)."

"…there is much concern about ice-dependent seals (i.e., ring, spotted, bearded, and ribbon) that require ice for different parts of their life history (molting and pupping). There is also concern that the retreating ice is transporting some benthic-feeding, ice-dependent seals and walrus away from suitable feeding grounds (e.g., shallow, productive benthic habitats)."

Acidification

There is direct evidence of ocean acidification, observed as a decrease in pH and increase in inorganic carbon in the surface waters of a large section of the northeast Pacific Ocean (Kleypas et al. 2006). This increase in acidification is attributed to anthropogenic sources (i.e., burning of fossil fuels). Increased acidification affects the calcification process utilized by calcium-secreting organisms, such as pteropods and corals (Kleypas et al. 2006). Skeletal growth rates of these types of organisms are reduced by the increase in acidification, increased dissolution of carbonate and decreased CaCO3 saturation state; however, the combined effect of acidification, lights, nutrients, and temperature are unknown (Kleypas et al. 2006). This could have implications, as yet unknown, for the food web of the northeast Pacific ecosystem. Kleypas (et al. 2006) outline one hypothesized ecosystem response to increased acidification: "If reduced calcification decreases a calcifying organism's fitness or survivorship, then such calcareous species may undergo shifts in their latitudinal distributions and vertical depth ranges as the CO2/carbonate chemistry of seawater changes (Seibel and Fabry 2003)." Kleypas (et al. 2006) point out that, "It is not known whether planktonic calcifiers require calcification to survive (Seibel and Fabry 2003).… The capacity for planktonic organisms to adapt to lower saturation states (or reduced calcification rates) has not been investigated….Long-term impacts of elevated CO2 on reproduction, growth, and survivorship of planktonic calcifying organisms have not been investigated…The potential impacts of increased CO2 on planktonic ecosystem structure and functions are unknown."

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Chapter 4 Target Species

4.1 Gadoids, Flatfish, and Other Species

4.1.1 The Gadoid, Flatfish, and other species resource

This section of Chapter 4 describes the impacts of the alternatives on gadoid fishes (pollock and Pacific cod), flatfishes, and other species. Section 4.2 describes the impacts of the alternatives on rockfishes.

The GOA and BSAI FMPs define target species as 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 total allowable catch (TAC) is established annually for each target species. Catch of each species must be recorded and reported… (Section 3.1.2 of the BSAI and GOA groundfish FMPs, page 10).

The FMPs explicitly list target species. In the GOA, target species include walleye pollock, Pacific cod, sablefish, shallow and deep water flatfish, rex sole, flathead sole, arrowtooth flounder, Pacific ocean perch, shortraker rockfish, rougheye rockfish, northern rockfish, "other slope" rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, Atka mackerel, and skates (NPFMC 2005b, p.10). NPFMC approaches to allocation of TAC within target fisheries can vary. The TAC has been used to satisfy incidental catch requirements in other fisheries in the case of the following GOA target fisheries: Atka mackerel, shortraker rockfish, rougheye rockfish, thornyhead, and other rockfish (NPFMC 2004b).

In the BSAI, target species include 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 (NPFMC 2005a, p. 10).

Both the BSAI (NPFMC 2005a, p.10) and GOA (NPFMC 2005b, p.10) FMPs have "other species" categories that are defined as follows:

> …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.

In the BSAI this category includes sculpins, sharks, skates, and octopus, and in the GOA it includes squid, sculpins, sharks, and octopus.

The analysis in this chapter has been divided into two parts. Rockfish species are discussed in the next section (Section 4.2). This section focuses on pollock, Pacific cod, flatfish, Atka mackerel, and other species.

More information on the species discussed in this section may be found in the following sources (all website links tested in July 2006):

- Section 3.5.1 of the PSEIS contains overviews of the target species managed under the FMPs, while Section 3.5.2 contains descriptions of squid, skates, and other species. These sections are available on the NMFS Alaska Region's website at: http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm .
- The details of the Council's management programs for the groundfish species may be found in the BSAI and GOA groundfish FMPs. These are available from the Council's website at: http://www.fakr.noaa.gov/npfmc/default.htm .
- Council and AFSC staff have prepared "A Guide to Stock Assessment of Bering Sea and Aleutian Islands Groundfish." This may be accessed at the Council's web site: http://www.fakr.noaa.gov/npfmc/summary_reports/bsstock.htm
- The annual Stock Assessment and Fishery Evaluation (SAFE) reports summarize the best available scientific information on individual groundfish species. The reports from November 2005 may be found on the AFSC's web site at: http://www.afsc.noaa.gov/refm/stocks/assessments.htm . Reports for earlier years may also be accessed through this web site.

The general impacts of fishing mortality within FMP Amendment 56/56 ABC/OFL definitions are discussed in Section 4.1.3 of the PSEIS (NMFS 2004), and apply to all fish species for which a TAC is specified. Since 2002, a modified harvest control rule has applied to the directed fisheries for pollock, Pacific cod, and Atka mackerel (679.20(d)(4)). This rule closes directed fishing when the spawning biomass is estimated to be less than 20 percent of the projected unfished spawning biomass. This harvest control rule was evaluated in the Steller sea lion protection measures SEIS (NMFS 2001).

4.1.2 Impacts of alternative harvest strategies on gadoids, flatfish, and other species

Alternative harvest strategies are evaluated with respect to impacts on five indicators of resource health:

- *Fishing mortality*: Will fish harvests at the levels indicated in an alternative lead to overfishing or to an overfished status for a stock by removing a sufficient portion of the spawning population from the stock?
- *Spatial and temporal concentration*

- *Genetic structure of the population:* A fish stock is often a collection of genetically differentiated substocks; fishing at a constant rate on all the substocks can have greater adverse impacts on some than on others. Moreover, fishing for fish with certain characteristics (such as large size) can lead through time to selection for fish with certain characteristics (such as faster or slower growth rates).
    - *Reproductive success*: Fishing operations may interfere with or disturb spawning and reproductive behavior. Fish populations may exhibit density-dependent or compensatory behavior, resulting in increased reproductive success or juvenile survival rates, or depensatory decrease in juvenile survival at low population levels, raising concerns about species survival.
- *Prey availability*: Harvesting activity may change the prey available to target stocks.
- *Habitat:* Gear impacts on habitat may affect the ability of the habitat to support sustainable stock levels.

Any stock that is below its minimum stock size threshold (MSST) is defined as overfished. Any stock that is expected to fall below its MSST in the next two years is defined to be approaching an overfished condition. Overfishing is defined as any rate of fishing in excess of the maximum fishing mortality threshold (MFMT). The catch corresponding to fishing at a rate equal to the MFMT is referred to as the overfishing level (OFL). A thorough description of the rationale for the MSST can be found in the National Standard Guidelines 50 CFR Part 600 (63 *FR* 24212 - 24237). The "overfished," and "approaching an overfished' condition determinations are made using the following criteria (from the 2005 BSAI SAFE):

- *Is the stock overfished?* This depends on the stock's estimated spawning biomass in 2006:
    - If spawning biomass for 2006 is estimated to be below ½ $B_{35\%}$, the stock is below its MSST, where B is the biomass, and the expression "$B_{35\%}$" refers to the long-term average biomass that would be expected under average recruitment and a fishing rate that associated with an equilibrium level of spawning per recruit (SPR) equal to 35% of the equilibrium level of spawning per recruit in the absence of any fishing
    - If spawning biomass for 2006 is estimated to be above $B_{35\%,}$ the stock is above its MSST.
    - If spawning biomass for 2006 is estimated to be above ½ $B_{35\%}$, but below $B_{35\%}$, the stock's status relative to MSST is determined by referring to harvest scenario in which the fishing rate (F) is set equal to F_{OFL}. If the mean spawning biomass for 2016 is below $B_{35\%}$, the stock is below its MSST. Otherwise, the stock is above its MSST.
- *Is the stock approaching an overfished condition?* This is determined by referring to a harvest scenario in which F is set equal to F_{ABC}:
    - If the mean spawning biomass for 2008 is below ½ $B_{35\%,}$, the stock is approaching an overfished condition. If the mean spawning biomass for 2008 is above $B_{35\%}$, the stock is not approaching an overfished condition.
    - If the mean spawning biomass for 2008 is above ½ $B_{35\%}$, but below $B_{35\%}$, the determination depends on the mean spawning biomass for 2018. If the mean spawning biomass for 2018 is below $B_{35\%}$, the stock is approaching an overfished condition. Otherwise, the stock is not approaching an overfished condition.

It is currently impossible to evaluate the status of stocks in Tiers 4 through 6 with respect to their MSSTs because reference stock levels (such as MSST) cannot be estimated reliably.

The overfished and overfishing criteria can be evaluated with Figures 4-1 and 4-2 below. These figures summarize the available information on current fishing in relation to MSY and current biomass in relation to the biomass associated with MSY, for species in Tiers 1 to 3.

The x-axis shows the ratio of the 2006 biomass to the biomass associated with MSY. The B_{MSY} is $B_{35\%}$. Increases in the 2006 biomass level extend to the right along the x-axis. The vertical lines mark where the 2006 biomass is equal to one half of B_{MSY} at 0.5, and where it is equal to B_{MSY} at 1.0. The x-axis also is an indicator of overfishing (defined above as fishing in excess of the OFL). Points falling to the left of the one half B_{MSY} line are considered overfished and those falling to the left of the B_{MSY} line are approaching an overfished condition. Examination of the two figures below shows that none of these species are subject to overfishing.

The y-axis shows the ratio of the estimated catch in 2005 (not TAC or ABC) to the MSY. The MSY is proxied by the OFL recommendation for 2005. As 2005 catch increases in relation to MSY, points move up the axis. The horizontal red line indicates the point where the 2005 catch is equal to MSY.

All but one of the fisheries evaluated in both the GOA and the BSAI, fall to the right of the vertical line showing equality between the 2006 biomass projection and the B_{MSY}. The one species that falls just to the left of this vertical line, GOA pollock, has a $B_{35\%}$ equal to 196,000 mt, and a projected 2016 biomass of 219,280 (Fig. 4-2). Therefore, this species is not considered overfished (NPFMC 2005c, pp. 76, 101). Currently no stocks are approaching an overfished condition (NPFMC, 2004a, 2004b, 2005c, 2005d).

Figure 4-1 Overfished and overfishing status for Tier 3 target groundfish species in the BSAI

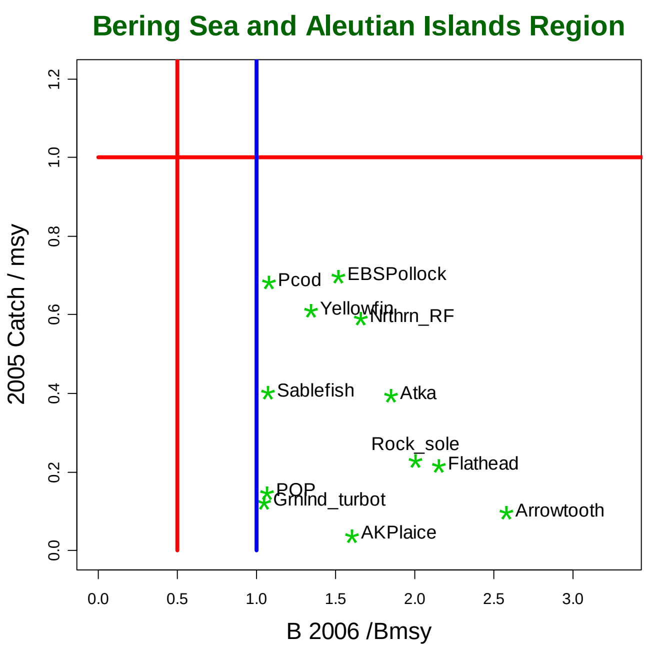
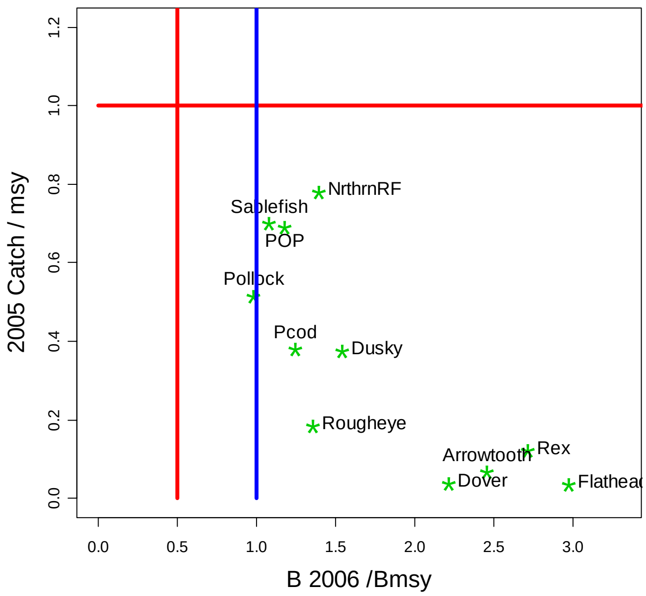


Figure 4-2 Overfished and overfishing status for Tier 3 target groundfish species in the GOA



It is currently impossible to evaluate the status of stocks in Tiers 4 through 6 with respect to MSST, because stocks qualify for management under these tiers only if reference stock levels (such as maximum sustainable yield or MSST) cannot be estimated reliably. For Tier 4-6 stocks, an OFL can be determined and therefore is used to determine the significance of fishing mortality for these species. Genetic structure and reproductive success in terms of meeting the MSST cannot be determined for Tier 4-6 species. If the fishing mortality is maintained below the OFL for these species, as NMFS expects it will be, the likelihood of adverse effects on genetic structure and reproductive success are reduced.

In summary, under all alternatives, the spawning stock biomass of all target species that have calculated spawning stock biomasses are expected to be above their MSST. The probability that overfishing would occur is low for all of the stocks. These stocks are not expected to approach an overfished condition. Harvests of stocks in Tiers 4 to 6 are expected to be under OFL levels. This action is not expected to jeopardize the capacity of the stocks to produce maximum sustainable yield on a continuing basis.

The expected changes that would result from harvest at the levels proposed are not substantial enough to expect that the genetic diversity or reproductive success of these stocks would change. None of the alternatives would allow overfishing of the Tier 1 to 3 spawning stocks. Therefore, the genetic integrity and reproductive potential of the stocks should be preserved. No Tier 4-6 stocks should experience overfishing and they are unlikely to have changes in genetic structure or reproductive success based on fishing activities. None of the alternatives are expected to (1) alter the genetic sub-population structure such that it jeopardizes the ability of the stock to sustain itself at or above the MSST or experience overfishing; (2) decrease reproductive success in a way that jeopardizes the ability of the stock to sustain itself at or above the MSST.

Groundfish fishing may have complex impacts on prey. Fishing may reduce competition for prey by harvesting fish that consume prey used by other fish. For example, harvest of fish that prey on euphausiids may reduce competition faced by other species for euphausiids. Harvest of groundfish may also remove groundfish used as prey by other groundfish. Key species here appear to be pollock in the GOA, EBS, and AI, and Atka mackerel in the AI (NMFS, 2004, p A-3.5-71 to A-3.5-73). Predator-prey ecosystem relationships may be complex and hard to predict. For example, in the BSAI, adult pollock are important predators on juvenile pollock. Harvest of adult pollock may reduce competition for juvenile pollock faced by other species. Prey impacts under the Alternative 2 harvest strategy do not appear to have led to overfishing, and are not expected to do so under this action. As a possible qualification, note the discussion in Chapter 11, with respect to potential impacts of changes in GOA pollock biomass on biomass or body weight of Pacific cod and halibut. As noted in Chapter 10, the magnitude of Alternative 2 fishing on essential fish habitat will be minimal, the duration of impact will be persistent. This action is not expected to (1) alter harvest levels or distribution of harvest such that prey availability would jeopardize the ability of the stock to sustain itself at or above the MSST or experience overfishing, and (2) disturb habitat at a level that would alter spawning or rearing success such that it would jeopardize the ability of the stock to sustain itself at or above the MSST or prevent overfishing.

Table 4-0 Gadoid, flatfish, and other species impact summary

		Alternative 1	Alternative 2	Alternatives 3, 4, 5
Mortality		Mortality levels would be the same as those under Alternative 2 in the BSAI. Higher mortality levels for some species in the GOA. All species harvests expected to be within OFL levels.	Tier 3 species not overfished, not being overfished, and not approaching an overfished condition. Similar determinations cannot be made for species in other tiers, although overfishing is expected to be unlikely. All fishery harvests expected to be within OFL levels.	Harvest levels are lower under these alternatives.
Spatial and temporal impacts	Genetics	Not expected to alter the genetic sub-population structure for Tier 3 stocks in a way what would jeopardize MSST. Tier 4-6 stocks harvested within OFL reducing likelihood of adverse genetic structure impacts.	Not expected to alter the genetic sub-population structure for Tier 3 stocks in a way what would jeopardize MSST. Tier 4-6 stocks harvested within OFL reducing likelihood of adverse genetic structure impacts.	Genetic impacts would be smaller under these alternatives.
	Reproductive success	Not expected to affect reproductive success Tier 3 stocks in a way what would jeopardize MSST. Tier 4-6 stocks harvested within OFL reducing likelihood of adverse impacts on reproductive success.	Not expected to affect reproductive success Tier 3 stocks in a way what would jeopardize MSST. Tier 4-6 stocks harvested within OFL reducing likelihood of adverse impacts on reproductive success.	Impacts on reproduction would be less under these alternatives.
Prey		Impacts on prey could be greater than Alternative 2.	Not expected to lead to overfishing.	Impacts on prey would be smaller under these alternatives.
Habitat		Impacts on habitat could be greater than under Alternative 2.	Impacts are expected to be minimal and persistent.	Impacts on habitat would be smaller under these alternatives.

4.1.3 Reasonably foreseeable future actions that may affect the impact of groundfish fishing on gadoids, flatfish, and other species

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on target species. These actions are described in Section 3.2.

Ecosystem-sensitive management

Ecosystem-sensitive management is likely to benefit target species. The specific actions that will be taken to implement an ecosystem policy for fisheries management are unknown at this time; therefore, the significance of cumulative effects of ecosystem policy implementation on mortality, spatial and temporal distribution of the fisheries, changes in prey availability, and changes in habitat suitability are unclear. However, these actions may enhance the ability of stocks to sustain themselves at or above MSST, as ways are found to introduce ecosystem considerations into the management process.

As noted in Section 3.2.2, an increased understanding of interactions between ecosystem components is reasonably foreseeable. This coupled with another reasonably foreseeable action, increased integration of ecosystem considerations into fisheries decision-making, is likely to result in fishery management that reduces potential adverse impacts of the proposed action on target stocks. An example of the ways new information may change our perspectives was suggested at a workshop on multi-species and ecosystem-based management held at the February 2005 Council meeting. Multi-species and ecosystem projections of biomass impacts from eliminating fishing mortality for 20 years were compared to similar estimates made with single-species models. A report of the discussions noted that, "Results… were similar for top predators such as Pacific cod and Greenland turbot. However, results for walleye pollock, a key forage species, showed different results when predator/prey interactions were included. Both the multi-species and ecosystem models predicted much more modest increases in pollock biomass than did the single-species model, as predation increased to compensate for the increase in food supply." (NMFS 2005, p. 23) Predation here refers to cannibalism of juvenile pollock by larger adult pollock.

The Council has been investigating and taking steps to implement measures to provide more protection to non-target species. In 1998, the State of Alaska recommended that the Council revise management of sharks and skates in the EEZ off Alaska to prevent development of directed fisheries on these long-lived, slow recruiting species. The Council expanded this initiative, first in 2002 to all components of the "other species" category, and then to all non-target species in 2003, but would limit directed fishing on non-target species until sufficient information is available to estimate the OFL. The Council's Non-target Species Committee was formed in October 2003 to develop improved measures to manage non-target species. The Council's non-target species initiative has led to three FMP amendments: (1) GOA Amendment 63 in 2004 that separated skates from the GOA "other species" category; (2) GOA Amendment 69 in 2005 that led to a more conservative approach to "other species" TAC setting (as discussed below); and (3) a BSAI and GOA "other species" assemblage amendment that is scheduled for analysis in 2007. Initiation of a fourth amendment for a long term solution for managing BSAI and GOA non-target groundfish has been suspended until final revised guidelines for National Standard 1 are published (the proposed rule was published on June 22, 2005 (70 FR 36242).

In 2005, the AFSC prepared separate SAFE chapters for the species in the "other species" complex in the BSAI. In 2006, the AFSC updated these, and will prepare separate SAFE chapters for the individual species in the GOA "other species" complex (Hollowed and Rigby 2006).

Rationalization

Fisheries rationalization would make large changes to the way the fisheries are managed and would primarily affect the allocation of harvest amounts. The future effects on target species are minimal because rationalization would not change the setting of TACs, which control the impacts of the fisheries on fishing mortality. However, to the extent rationalization improves fishing practices and the manageability of the fisheries, it could reduce the adverse effects of the proposed action on target species. The GOA Rockfish Demonstration Project and the rationalization of the non-AFA BSAI large vessel trawl fishery will both increase observer coverage and improve the use of scales, leading to better estimates of catch in these fisheries.

Traditional management tools

Future harvest specifications will primarily affect fishing mortality as the other significance criteria for target species (temporal and spatial harvest, prey availability, and habitat suitability) are primarily controlled through regulations in 50 CFR part 679. The setting of harvest levels each year is controlled to ensure the stock can produced MSY on a continuing basis and to prevent overfishing. Each year's setting of harvest specifications include the consideration of past harvests and future harvests based on available biomass estimates. In-season managers close fisheries to directed fishing as fishermen approach TACs, treat species whose TACs have been taken as prohibited species, and introduce fishing restrictions, or actual fishery closures, in fisheries in which harvests approach OFL. The 2 million mt OY in the BSAI also contributes significantly to preventing overharvests. The controls on fishing mortality in setting harvest specifications ensure the stocks are able to produce MSY on a continuing basis.

A large proportion of the groundfish fleet now carries VMS due to VMS requirements introduced in connection with the Steller sea lion protection measures, EFH/HAPC protection measures, and the Crab Rationalization Program. In-season managers currently use VMS intensively to manage fisheries so that harvests are as close to TACs as possible. VMS has also become a valuable diagnostic tool for addressing situations with unexpected harvests. It was used as a diagnostic tool in July 2006 to investigate the sources of a sudden and unexpected bycatch of squid in the pollock fishery. As agency experience with VMS grows, it should allow in-season managers to more precisely match harvests to TACs, reducing potential overages, and maximizing the value of TACs to industry. Extension of VMS will be associated with larger costs for vessels that will adopt it.

Other government actions

Alaska may expand State-managed or State parallel groundfish fisheries. While the State sets its guideline harvest levels in its State-managed fisheries, adjustments are typically made to Federal TACs to keep combined State and Federal harvests of the relevant species below the ABC and OFL for the species. State parallel fisheries are conducted within the Federal TACs. Alaska is considering opening new pollock fisheries in Cook Inlet and in the Aleutians Islands near Adak. The BOF is scheduled to discuss this in October 2006 (H. Savikko, pers. comm., July 18, 2006). Depending on the action the State takes, the action could have little impact on pollock stocks. In February 2006 the BOF created a new Pacific cod fishery in State waters in the Aleutian Islands. In 2006, NMFS responded to this action with an in-season action decreasing the Federal BSAI Pacific cod TAC by 3 percent. If the State continues this fishery, the Council and NMFS are expected to continue to modify TACs to accommodate it within the overall ABC for the BSAI (M. Furuness, pers. comm., July 18, 2006).

Private actions

Fishing activities by private fishing operations, carried out under the authority of the annual harvest specifications, are an important class of private action. The impact of these actions has been considered under traditional management tools.

A private action not treated above is the MSC environmental certification of fisheries. The MSC certified BSAI and GOA pollock, Pacific cod, halibut, and sablefish. Certification will have to be renewed in the future. If the MSC environmental certification has important marketing benefits, this will increase industry incentives to address the environmental issues connected with the fishery. In this context, it may tend to lengthen industry's time horizon, and increase its interest in target stock sustainability. More information on the MSC certification program may be found on the internet at http://eng.msc.org/.

Increasing economic activity in and off of Alaska may affect future fisheries. The high levels of traffic between the West Coast and East Asia raise concerns about pollution incidents or the introduction of invasive species from ballast water. Pollution issues were highlighted in December 2004 when the M/V Selendang Ayu wrecked on Unalaska Island and again in July 2006 with the M/V Cougar Ace accident. Alaskan economic development can affect the coastal zone and species that depend on the zone. However, Alaska remains relatively lightly developed compared to other states in the nation. Marine transportation associated with that development may be more of a concern than in other states, due to the relatively greater importance of marine transportation to Alaska's economy.

The development of aquaculture may affect prices for, and the harvest of, some species. For example, the development of sablefish aquaculture may reduce wild sablefish prices and reduce interest in sablefish harvests in high-operating-cost areas in the BSAI where sablefish TACs are currently not fully harvested. As noted in Section 3.3, more direct impacts, through development of finfish aquaculture in waters off of Alaska, do not appear to be likely at this time.

4.1.4 References

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4.1.5 Preparer and Persons Consulted

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4.2 Rockfish

4.2.1 The rockfish resource

There are 33 species of rockfish (*Sebastes* spp. and *Sebastolobus* spp.) managed by the NPFMC (Table 4-1). Adults range in size from about 12 cm to about 104 cm, but most species are between 38 cm and 51 cm. Reproduction is generally through internal fertilization and live birth. Adult rockfish species have different habitats. Demersal shelf rockfish live in near-shore shallower waters on rocky bottom, pelagic shelf rockfish are often found near the bottom and up in the water column, and other species live in deeper waters. Some species of rockfish appear to be very site specific, never traveling far from a given location (Schwan 1994). Rockfish are long-lived, slow-growing fish with most species having maximum ages over fifty years old. Shortraker, rougheye, and yelloweye rockfish are some of the oldest of the rockfish. For example, rougheye rockfish have been aged as old as 200 years (Munk 2001). A fish that old would have been born when Jefferson was President.

Because some rockfish species on the U.S. West Coast have been overfished, the potential for overfishing Alaska rockfish due to unique life-history characteristics (low fecundity and slow growth in some cases, and localized populations for some species), has received increased attention. To address these concerns, in the summer of 2006, the Alaska Fisheries Science Center (AFSC) contracted with the Center for Independent Experts (CIE) to review the stock assessments and harvest strategy for Alaska's rockfishes.

The BSAI FMP identifies the following target rockfish species or species groupings for management purposes: Pacific ocean perch, northern rockfish, shortraker rockfish, rougheye rockfish, and "other rockfish" (NPFMC 2005a, p. 11).

The GOA FMP identifies the following target rockfish species or species groupings for management purposes: Pacific ocean perch, northern rockfish, rougheye rockfish, shortraker rockfish, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish (DSR), and thornyhead rockfish (NPFMC 2005b, p. 11).

The species in these groupings are listed in Table 4-1.

Table 4-1 Species included in the rockfish resource

BSAI	GOA
Pacific ocean perch (*Sebastes alutus)*	Pacific ocean perch (*Sebastes alutus)*
Northern rockfish (*Sebastes polyspinis*)	Northern rockfish (*Sebastes polyspinis*)
Shortraker rockfish (*Sebastes borealis*)	Shortraker rockfish (*Sebastes borealis*)
Rougheye rockfish (now believed to be two species: rougheye and blackspotted, *S. aleutianis and S. melanosticus*)	Rougheye rockfish (now believed to be two species: rougheye and blackspotted, *S. aleutianis and S. melanosticus*)
Other rockfish** • Red banded rockfish *Sebastes babcocki* • Dark dusky rockfish *Sebastes ciliatus* • Dusky rockfish *Sebastes variabilis* • Redstripe rockfish *Sebastes proriger* • Yelloweye rockfish *Sebastes ruberrimus* • Harlequin rockfish *Sebastes variegatus* • Sharpchin rockfish *Sebastes zacentrus* • Shortspine thornyhead *Sebastolobus alascanus*	Other slope rockfish • Sharpchin rockfish *S. zacentrus* • Redstripe rockfish *S. proriger* • Harlequin rockfish *S. variegatus* • Silvergrey rockfish *S. brevispinis* • Redbanded rockfish *S. babcocki* • Yellowmouth rockfish *S. reed* • Bocaccio *S. paucispinis* • Greenstriped rockfish *S elongatus* • Darkblotched rockfish *S. crameri* • Pygmy rockfish *S. wilsoni* • Splitnose rockfish *S. diploproa* • Blackgill rockfish *S. melanostomus* • Chilipepper *S. goodi* • Stripetail rockfish *S. saxicola* • Vermilion rockfish *S. miniatus* • Northern rockfish *S. polyspinis*
	Pelagic shelf rockfish • Dusky rockfish *(S. variabilis)* • Dark rockfish (*S. ciliatus*) • Widow rockfish (*S. entomelas*) • Yellowtail rockfish (*S. flavidus*)
	Demersal shelf rockfish • canary rockfish *S. pinniger* • China rockfish *S. nebulosus* • copper rockfish *S. caurinus* • quillback rockfish *S. maliger* • rosethorn rockfish *S. helvomaculatus* • tiger rockfish *S. nigrocinctus* • yelloweye rockfish *S. ruberrimus*
	Thornyhead rockfish • shortspine thornyhead *Sebastolobus alascanus* • longspine thornyhead *Sebastolobus altivelis* • broadfin thornyhead *Sebastolobus macrochir*
**The other species complex includes 28 species of rockfish. However, most are not believed to be present in the BSAI in significant numbers. The complex is managed for the eight species listed (NPFMC 2004b, p 823).	

To facilitate this analysis, these species have been grouped into the following six categories: Pacific ocean perch, northern, rougheye, GOA dusky, and shortraker rockfish, and "other rockfish".

- Pacific ocean perch and northern rockfish have been treated independently since each is the subject of TACs in the BSAI and the GOA, and since each is the subject of targeted fishing. Pacific ocean perch is targeted in the AI and in the GOA, but not in the EBS. Northern rockfish are targeted in the Western and Central GOA, but not in the BSAI.

- Dusky rockfish is part of the "other rockfish" category in the BSAI and the "Pelagic shelf rockfish" category in the GOA. In this analysis, GOA dusky rockfish are treated separately, since they are the subject of a targeted fishery. BSAI "other rockfish" TACs have been set low in recent years to preclude a targeted fishery, and BSAI dusky rockfish are analyzed as part of the "other rockfish" grouping.
- Shortraker and rougheye rockfish are treated separately because they are subject to separate TACs in the BSAI and GOA, and also because, although TACs are set low enough to preclude directed fishing, both have valuable markets in Asia.
- "Other rockfish" species have been grouped together because they are not broken out separately in the TAC specifications. These species lack much basic biological information and are only allowed as incidental catch, thus fishery mortality overall for these groups is low. Dusky rockfish are treated as a part of the "other rockfish" grouping in the BSAI, but are discussed separately in the GOA (as noted above).

Pacific ocean perch are the subject of a directed trawl fishery in the Aleutian Islands and the Gulf of Alaska, and are taken as bycatch in the Atka mackerel fishery. Northern rockfish are primarily taken as bycatch in the Aleutian Islands Atka mackerel fishery and as a target by bottom trawlers in the GOA. Dusky rockfish are a targeted fishery in the GOA. Dusky rockfish are generally targeted after the Pacific ocean perch fishery closes, and generally targeted jointly with northern rockfish. Shortraker and rougheye rockfish and the remaining species are harvested incidentally in fisheries including targeted rockfish, flatfish, sablefish, Pacific cod, and Atka mackerel (M. Furuness, pers. comm., July 28, 2006)

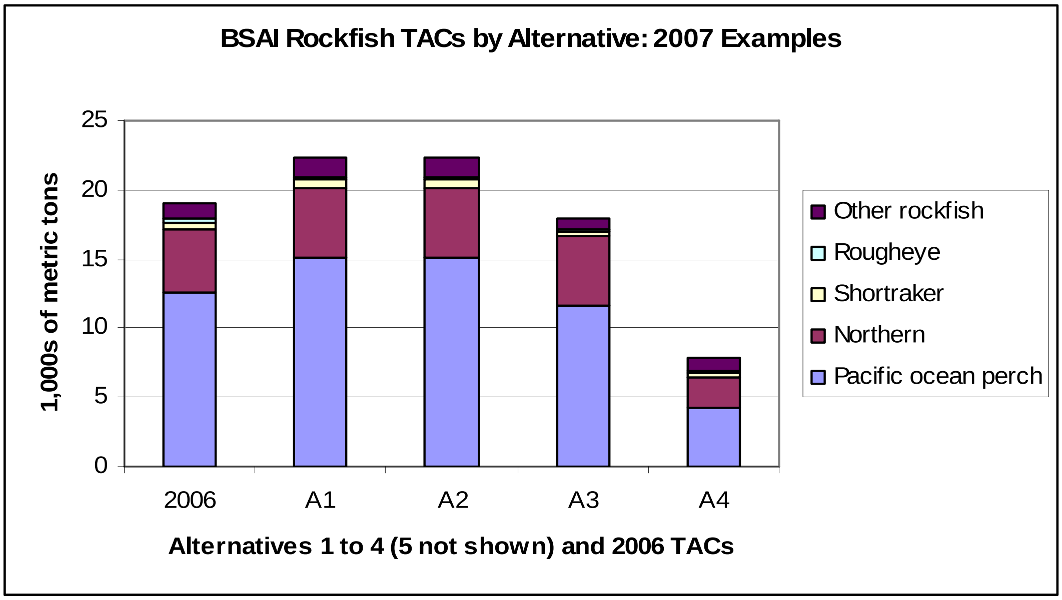
More information on the rockfish in Alaska's EEZ may be found in several NMFS and Council documents (links tested July 2006):

- The AFSC maintains a web page on its rockfish research program at www.afsc.noaa.gov/abl/MarFish/Rockfish.htm. The AFSC has prepared a guide to North Pacific rockfishes, "Guide to Rockfishes (Scorpaenidae) of the Genera *Sebastes*, *Sebastolobus*, and *Adelosebastes* of the Northeast Pacific Ocean." and posted it to the website listed above.
- Clausen and Heifetz published a comprehensive paper on northern rockfish in the Marine Fisheries Review in 2002. This is on the Review's website: http://spo.nwr.noaa.gov/mfr644/mfr6441.pdf .
- The Council's Fishery Management Plans for the BSAI and GOA include discussions of rockfish species. As noted above, the FMPs define the species groups. Sections 4.2.2 in each document describe essential rockfish habitat. Appendix D in each document provides information on rockfish life history (NPFMC 2005a, 2005b). The management plans are available online at http://www.fakr.noaa.gov/npfmc/default.htm .
- The Programmatic Groundfish EIS (PSEIS) discusses rockfish and the impacts of the preferred programmatic FMP alternatives in Sections 3.5.4 and 4.9.4 (NMFS 2004). The groundfish PSEIS is online at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm .
- The Essential Fish Habitat/Habitat Areas of Particular Concern EIS describes the rockfish species in the GOA and BSAI in Section 3.2.4.2. Appendix Section B.3.4 describes the impacts of fishing on essential fish habitat for forage species (NMFS 2005). The EFH EIS is online at http://www.fakr.noaa.gov/habitat/seis/efheis.htm .

4.2.2 Impacts of alternative harvest strategies on rockfish

Example TACs for each of the alternative harvest strategies can be found in Chapter 2. The rockfish TACs for the BSAI and GOA are shown in Figures 4-3 and 4-4 below.

Figure 4-3 Rockfish TACs under BSAI Alternatives compared to 2006 TAC levels



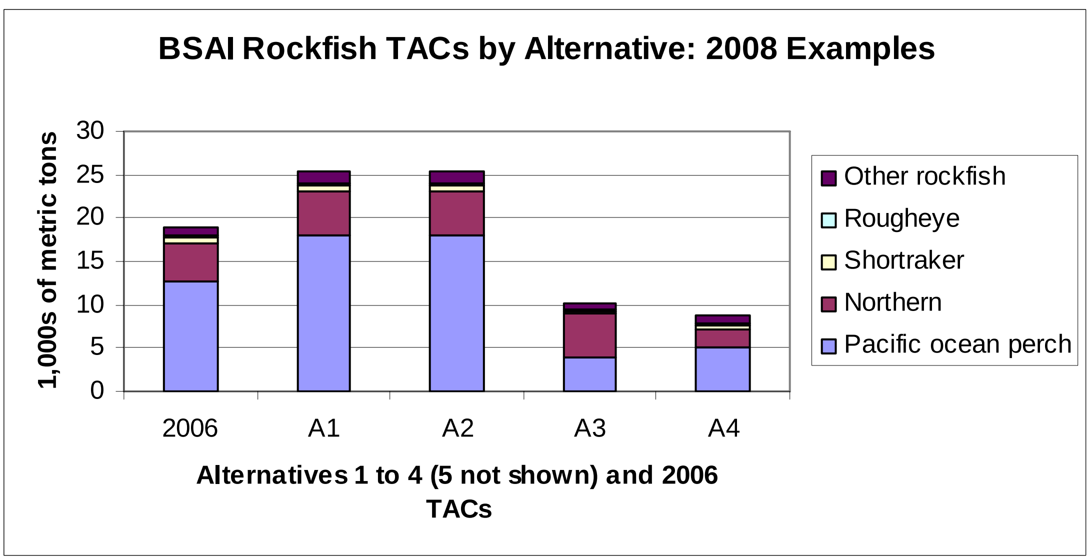
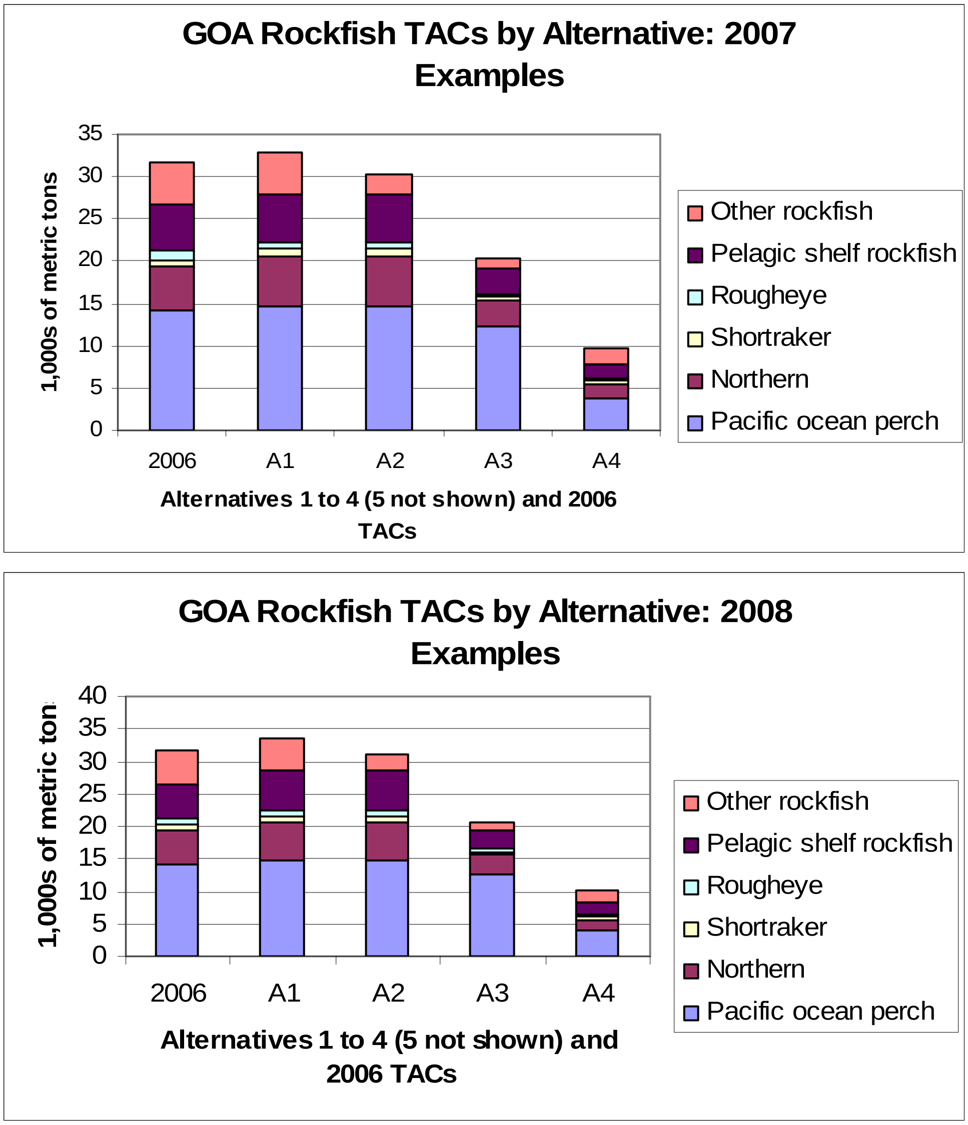


Figure 4-4 Rockfish TACs under GOA Alternatives compared to 2006 TAC levels



The impacts of the groundfish specification harvest strategy alternatives on rockfish are evaluated using the same indicators used for the other target species of fish, and for non-specified species of fish. These are catch impacts on: (1) mortality, (2) genetic structure of population, (3) reproductive success, (4) prey availability, and (5) habitat. Reproductive success is one measure of the impact of spatial and temporal concentration of fishing on the stocks. One concern of spatially and temporally concentrated fishing is its potential impact on genetically unique stocks. These criteria are discussed in Section 4.1.

Mortality

Criteria governing determinations of overfishing, overfished stocks, and stocks approaching an overfished condition, were discussed in Section 4.1.2. Determinations can be made for stocks in Tier 3. In the BSAI, the Tier 3 stocks include Pacific ocean perch and northern rockfish, and in the GOA, Tier 3 stocks include Pacific ocean perch, northern rockfish, rougheye rockfish, and dusky rockfish. Dusky rockfish is the primary species harvested in the "pelagic shelf rockfish" complex. Determinations cannot be made using these criteria for rockfish species in Tiers 4 and 5, because reference stock levels cannot be estimated reliably.

None of the species for which determinations can be made are overfished, approaching an overfished condition, or subject to overfishing. Note that all rockfish stocks with age-structured models are Tier 3 stocks. Tier 3 stocks do not have reliable estimates of MSY or $F_{msy,}$ and $F_{35\%}$ is used as a proxy to F_{msy}. Figures 4-1 and 4-2, in Section 4.1 of this chapter, summarize information on (a) the relationship between the 2005 catch and MSY or MSY proxy (the 2005 OFL recommendation, based on $F_{35\%}$ for Tier 3 stocks), and (b) the relationship between estimated 2006 biomass and B_{msy} or B_{msy} proxy (for Tier 3 stocks, the estimated biomass associated with equilibrium fishing at $F_{35\%}$). These show that Pacific ocean perch, northern rockfish, and dusky rockfish do not currently appear to be overfished in the GOA or the BSAI, and that overfishing does not appear to be occurring.

The 2005 catch for Pacific ocean perch is a small fraction of the 2005 OFL recommendation (the MSY proxy) in the BSAI, and below it in the GOA. In both management areas, the biomass is slightly above the B_{msy} proxy of $B_{35\%}$. Northern rockfish catches are well below the 2005 OFL recommendations in both management areas, and northern rockfish biomass is well above the estimated B_{msy} proxy of $B_{35\%}$ in both areas. In the GOA, dusky rockfish catch was also well below the OFL recommendation and the biomass is well above the estimated B_{msy} proxy of $B_{35\%}$. These are population-level results. Where population structure exists, subpopulations may be under greater stress. None of these species appears to be approaching an overfished condition (J. Ianelli, pers. comm., July 2006).

The Council has taken a precautionary approach to fisheries management; the current approach reflects the uncertainties associated with the scientific understanding of rockfish biology, and ecosystem relationships. Multiple layers of precaution are built into catch levels for North Pacific rockfish with age structured models (Tier 3). For example, GOA Pacific ocean perch are assigned an F_{ABC} at $F_{40\%}$. Bayesian spawner recruit analysis showed that MSY was attained at approximately $F_{29\%}$. While the target fishing mortality is already well below MSY, the Southeast Outside district of the GOA is closed to trawling, further reducing fishing mortality by 10 percent. The fishing mortality derived from an $F_{40\%}$ strategy is much lower for rockfish than the fishing mortalities derived from the same harvest strategy for other species because of their sensitive life history characteristics (slow growth and low natural mortality). For example, the fishing mortality rate for a rougheye rockfish is about one tenth the fishing mortality rate for a Pacific cod. Another precautionary layer is to employ a catchability coefficient near two. This means that the fishing mortality is applied to a biomass estimate that is about half of the biomass estimate that is derived from the trawl survey. The age-structured modeling approach integrates a variety of information to compensate for variable survey results. Catch levels for North Pacific rockfish with survey-biomass based models (Tier 5) are based on highly variable biomass estimates. This variability is stabilized by using a 3-survey moving average. The catch levels for these species are set by applying a fishing mortality of 75 percent of the natural mortality estimate to the average exploitable biomass. These fishing mortalities are precautionary in that they are likely at least 25 percent below MSY fishing mortality (in Tier 3 rockfish, $F_{40\%}$ is slightly greater than M).

The discussion above relates to population level management. Localized depletion may be a concern if genetically important sub-populations are depleted within a distinct local region. This may be a concern for rockfish because some species may have stock structure within relatively small regions. Management of Alaska rockfish often is based on separate regional TACs, especially in the GOA, however, these remain relatively large regions.

Hanselman et al. (*in press*), investigated the potential for localized depletion of three rockfish species managed in the GOA and BSAI. The paper examined observer data for Pacific ocean perch, northern rockfish, and dusky rockfish, and showed variable results by species, location, and year. In summary, of the three species, depletions were detected in all three, most were short in time, with replenishment by the following year. In one case, however, northern rockfish showed longer-term depletion. This could be a concern, depending on the importance of the area as a spawning ground, and on the genetic structure of the population (D. Hanselman, pers. comm., July 28, 2006)

Table 4-2 summarizes the rockfish mortality results impacts associated with the five alternatives.

Table 4-2 Rockfish mortality impact summary

	Alternative 1	Alternative 2	Alternative 3, 4, 5
Pacific ocean perch	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Not currently overfished, approaching an overfished condition, or subject to overfishing in either the BSAI or GOA.	TACs are lower than Alt 2 for all three alternatives in the BSAI and GOA. Alt 2 conclusions hold under all alternatives.
Northern	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Not currently overfished, approaching an overfished condition, or subject to overfishing in either the BSAI or GOA.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Alt 2 conclusions hold under all alternatives.
Rougheye	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Not currently overfished, approaching an overfished condition, or subject to overfishing in either the GOA. In the BSAI, rougheye are managed as a Tier 5 species, and it is not possible to determine whether Tier 5 species are overfished, or approaching an overfished condition.	Rougheye TACs are equal to or less than Alt 2 in GOA, and in the BSAI in 2008. They exceed Alt 2 TACs in the BSAI in 2007 for Alt 3. In absence of a Tier 3 model, Alt 3 TAC is based on average catch in last five years. This exceeds the ABC in 2007 but is less than the OFL. This TAC would not be allowable under the BSAI FMP, and would have to be limited to ABC.
GOA Dusky	Pelagic shelf rockfish Alt 1 and Alt 2 TACs are equal in the GOA. Alt 2 conclusions hold under Alt 1.	Not currently overfished, approaching an overfished condition, or subject to overfishing in the GOA.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Alt 2 conclusions hold under all alternatives.
Shortraker	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Shortraker is treated as a Tier 5 species in the GOA and the BSAI, and it is not possible to determine whether or not Tier 5 species are overfished, approaching an overfished condition, or subject to overfishing.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Alt 2 conclusions hold under all alternatives.
Other rockfish	Alt 1 and Alt 2 TACs are equal in the BSAI. Alt 1 TACs are higher in the GOA, but still subject to the harvest control rules of the GOA FMP. Alt 2 conclusions hold under Alt 1.	It is not possible to determine whether Tier 5 species are overfished, or approaching an overfished condition, or subject to overfishing.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Alt 2 conclusions hold under all alternatives.

Genetic structure of the population

As noted in Section 4.1, a fish population may exhibit regional genetic heterogeneity due to limited gene flow by larval drift or by migration of adults. These differences arise strictly by the neutral evolutionary processes of migration and genetic drift. Even genetically similar groups with high levels of migration may show different regional phenotypic responses (e.g. growth rates) in response to different environmental conditions (e.g. prey availability). Fishing activity may also have potential genetic consequences in targeted populations. Selection for fish with certain heritable genetic characteristics (e.g. faster light coloration) may, over time, produce genetic changes relative to unfished population, but the genetic traits influenced by fishing pressure have not been investigated.

The management process contains several elements that should help to mitigate potential genetic problems. Separate rockfish OFLs, ABCs, and TACs are established for the BSAI and the GOA, and within the GOA there are separate OFLs, ABCs, and TACs for the eastern, central, and western management areas for some species. For some species there are finer regional breakouts in the eastern GOA. Precautionary overall TACs should also mitigate against excessive localized depletion of sub-populations.

Understanding of the extent of genetically based stock structure in the BSAI or GOA, or the extent to which fishing activity may be selecting for distinctive traits in rockfish populations is relatively limited. However, Alaska rockfish genetics and analysis of stock structure is a subject of ongoing research (P. Spencer, pers. comm.).

Pacific ocean perch: Seeb and Gunderson (1988), using allozymes, did not find genetically distinct stocks in the range from Washington to the AI, but they did find that the genetic makeup of the fish varied gradually over the range. Preliminary results using microsatellite DNA, which has more power to detect differences, suggest that there are genetically distinct populations, possibly at a relatively small spatial scale. Withler et al. (2001) found genetically distinct populations over fairly small distances in British Columbia. Withler's results might occur if adult Pacific ocean perch do not migrate far from their natal grounds and larvae are entrained by currents in localized retention areas (NPFMC 2005d, pp. 527-528; 2004a, pp. 677-678; D. Hanselman, pers. comm.).

Northern rockfish: Available genetic evidence for northern rockfish does not suggest the presence of stock structure. However the evidence is based on small samples, examined for a subset of characteristics, and obtained from only three locations, so the evidence for a lack of structure is not strong. Additional research on northern rockfish is currently underway at the University of Alaska, Fairbanks (NPFMC 2004a; 2005c; 2005d).

Dusky rockfish: The 2005 GOA Pelagic shelf rockfish SAFE document (NPFMC 2005d) reports that, "no studies have been done to determine if the Gulf of Alaska population of dusky rockfish is one stock, or if subpopulations occur. No stock identification work has been done on dark, widow, or yellowtail rockfish as widow and yellowtail rockfish are generally considered minor species in Alaska waters and dark rockfish have recently been described."

Rougheye rockfish: Recent genetic analysis indicates that rougheye rockfish is actually two distinct species, called rougheye rockfish (*Sebastes aleutianus*) and (tentatively) blackspotted rockfish (*S. melanosticus*). The species overlap in habitat, but may have different centers of distribution. Both range from the EBS south through the GOA, however, blackspotted rockfish is the only species found in the central and western AI. Blackspotted rockfish may also occur in somewhat deeper waters than rougheye rockfish. Both species exhibit weak but detectable genetic structure. Management areas seem to be appropriate for blackspotted rockfish, but may be too large for rougheye (Gharrett et al. 2006). Both species of rougheye are currently managed under the same TACs in the BSAI and GOA. Genetic studies suggest that *S. aleutianus* shows genetic structure in the GOA, but further research is necessary to better define that structure (NPFMC 2005d, p. 643).

Shortraker rockfish: Genetic research suggests that shortraker rockfish have population structure (Matala et al. 2004). However the evidence also suggests that the structure may be roughly consistent with the existing management areas. According to the GOA SAFE document, “the most efficient partitioning of the genetic variation into non-overlapping sets of populations identified three groups: a southeast Alaska group, a group extending from southeast Alaska to Kodiak Island, and a group extending from Kodiak Island to the central Aleutians (the western limit of the samples)” (NPFMC 2005c, p. 750).

Other rockfish: Very little is known about the genetics of “other rockfish” species.

Table 4-3 summarizes the rockfish genetics conclusions.

Table 4-3 Rockfish genetics indicator

	Alternative 1	Alternative 2	Alternatives 3, 4, and 5
Pacific ocean perch	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	There is evidence that Pacific ocean perch can show population structure at spatial scales smaller than federal management areas. Genetic impact is unknown.	TACs are lower than Alt 2 for all three alternatives in the BSAI and GOA. If genetic impacts exist they should be smaller under these alternatives.
Northern	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Weak evidence suggests a lack of stock structure for this species. Genetic impact is unknown.	Weak evidence suggests a lack of stock structure for this species.
Rougheye	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Rougheye rockfish is now believed to consist of two genetically distinct species. Blackspotted rockfish appear to show population structure roughly consistent with existing management areas, while rougheye rockfish may not. Genetic impact is unknown.	Rougheye TACs are equal to or less than Alt 2 in GOA, and in the BSAI in 2008. They exceed Alt 2 TACs in the BSAI in 2007 for Alt 3. In absence of a Tier 3 model, Alt 3 TAC is based on average catch in last five years. This exceeds the ABC in 2007 but is less than the OFL. This TAC would not be allowable under the BSAI FMP, and would have to be limited to ABC. If genetic impacts exist, they should be smaller, or no worse, under these alternatives.
GOA Dusky	Pelagic shelf rockfish Alt 1 and Alt 2 TACs are equal in the GOA. Alt 2 conclusions hold under Alt 1.	No evidence is available on dusky stock structure in the GOA. Genetic impact is unknown.	No evidence is available on dusky stock structure in the GOA.
Shortraker	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Some evidence for stock structure, but broadly consistent with existing management areas. Genetic impact is unknown.	Some evidence for stock structure, but broadly consistent with existing management areas.
Other rockfish	Alt 1 and Alt 2 TACs are equal in the BSAI. Alt 1 TACs are higher in the GOA. Genetic impact may be larger in the GOA.	Little is known about the population structure for these species. Genetic impact is unknown.	TACs are lower than Alt 2 for all three alternatives in the BSAI and GOA. If genetic impacts exist they should be smaller under these alternatives.

Reproductive success

Reproductive success is interpreted here as including the processes of mating and birth, and growth to sexual maturity. Reproduction is therefore interpreted as covering the processes governing the recruitment of sexually mature adults to the spawning population.

Pacific ocean perch: Little is known about the impact of fishing activity on Pacific ocean perch reproductive success. In both the BSAI and the GOA, targeted fishing is highly concentrated in mid-summer, while insemination is believed to take place in the fall with parturition in the spring. Thus, targeted fishing activity is believed to have little impact on spawning aggregations, gravid females, or on parturition (NPFMC 2005d, p. 544). There is no evidence that "habitat impacts have affected the ability of BSAI Pacific ocean perch to conduct mating and spawning processes, although it should be noted that very little is known regarding these processes." A similar conclusion holds in the GOA (NMFS 2005, pp. B-93, B-100). Post-larval and young juvenile Pacific ocean perch are pelagic and drift with the currents. There is evidence that older juveniles exploit demersal habitat with living and non-living structure, possibly as refugia from predators. Bottom trawling activity may affect these habitats and may affect survival rates for juveniles. There is some evidence for differential growth rates between high and low intensity trawl groups, but the cause is uncertain (NMFS 2005, pp. B-93-94, B-99-100). The EFH EIS describes the fishing impacts on spawning and breeding habitat as minimal, temporary, or non-existent in the BSAI and GOA, and the impacts on growth to maturity as unknown in the BSAI and GOA (NMFS 2005, pp. B-95, B-101).

Recent research on West Coast rockfish has suggested that survival rates may be higher for the larvae from older female rockfish (Berkeley et al. 2004). Older females have stopped growing or have begun to grow more slowly. They may be able to redirect available energy from growth towards reproduction. While larvae from older females in other species of fish have been found to have higher survival rates, this hasn't been documented for Alaska rockfish species at this time.

If larvae from older female Alaskan rockfish are found to have higher survival rates, there may be two, somewhat offsetting implications. First, fishing naturally leads to a compression of the age distribution of fish. Older fish become relatively scarcer. This may reduce the reproductive flow into a stock for any given number of fish remaining in the stock. On the other hand, past analysis of population and recruitment will have failed to recognize the full reproductive potential of the older females, and thus associated any given level of estimated recruitment with a reduced estimate of a stock's reproductive potential. As the estimate of the stock's reproductive potential is improved, there is a tendency for the stock-recruitment curve to become steeper at low stock sizes, indicating that modest increases in stocks are associated with relatively more recruits than otherwise believed.

It is impossible to tell, on the basis of theoretical considerations, which of the implications will be relatively more important. In order to determine the importance of the higher survival rates for larvae from older females, it is necessary to look at the biological parameters for a given stock. Depending on these parameters, an F_{MSY}, estimated with consideration of the maternal effects on larval survival, may be higher or lower than $F_{spr\%}$,[10] estimated without these considerations.

A recent study suggests the net impact may not be very large for Pacific ocean perch in the GOA or the BSAI (Spencer et al. *in press*). In their model the authors created a simulation using biological parameters used in normal modeling of this stock, but they substituted a measure of larval survival for larval production. They concluded that, "for Bering Sea/Aleutian Islands and Gulf of Alaska Pacific

[10] This is the fishing mortality rate at which the spawning biomass per recruit is at a given percent of the unfished values.

ocean perch, these two effects nearly counteract each other, producing F_{MSY} estimates which were relatively insensitive but decreased slightly as maternal effects were considered."

Northern rockfish: The 2005 GOA SAFE notes that little is known about the life history of northern rockfish. There have been no studies on fecundity of northern rockfish. Observations during research surveys in the Gulf of Alaska indicate that parturition (larval release) occurs in the spring and is completed by summer. The larvae metamorphose into a pelagic juvenile stage, but there is no information on when these juveniles become demersal. The impact of fishing on age-at maturity and fecundity is unknown. (NPFMC 2005d, pp. 581, 600). NMFS (2005) did not identify connections between habitat disturbance and spawning and breeding activity, although it noted that little is known about spawning behavior. It pointed to anecdotal evidence that northern rockfish may use bottom habitat with living and non-living structure as refuge from predators, and that fishing activity that modified this habitat might affect its suitability for that purpose. This document also noted some evidence from the GOA that where trawling intensity was high, average weight at length of northern rockfish was lower. The causes of this connection were not known. In both the BSAI and GOA, the EFH EIS found that the impact of fishing on spawning and breeding was minimal, temporary, or of no effect, and that the impact on growth to maturity was unknown (NMFS 2005, pp. B-110-118).

GOA dusky rockfish: The 2005 GOA SAFE document (NPFMC 2005d, p. 750) notes that the dusky rockfish trawl fishery in the Gulf of Alaska starts in July and usually lasts only a few weeks. The fishery is concentrated at a number of offshore banks on the outer continental shelf. There is no published information on time of year of insemination or parturition, but insemination is likely in the fall or winter, and anecdotal observations indicate parturition is mostly in the spring. Hence, reproductive activities are probably not directly affected by the commercial fishery. Nothing is known about dusky rockfish spawning and breeding requirements; NMFS (2005) concludes that fishing habitat-mediated impacts on spawning and breeding habitat are unknown. Similarly, nothing is known about the habitat needs for larval, post-larval, and younger juvenile dusky rockfish. Older juveniles have been found in connection with corals and sponges. The importance of this habitat to older juveniles was unknown, but trawling activity that affected it could affect growth of older juveniles. Considering all factors, the EFH EIS indicated that fishing habitat-mediated impacts on dusky rockfish were unknown (NMFS 2005, pp. B-118-119).

Rougheye rockfish: The 2005 GOA SAFE (NPFMC 2005d, p. 658) notes that fishery-specific concentration of target catch in space and time relative to spawning components are unknown. The EFH EIS notes that there is no evidence that habitat impacts have affected the ability of BSAI or GOA rougheye rockfish to conduct the mating and spawning processes, although little is known regarding these processes (NMFS 2005, p. B-103). Post larval and early juvenile rougheye are pelagic (NMFS 2005, p. B-102). Thus fishing is not likely to impact these stages. There is some reason to believe that older juvenile rougheye use bottom habitat with living and non-living structure as refuge from predators. Trawling activity that disturbs these habitats could affect growth of older juveniles, although there is no direct evidence of this (NMFS 2005, p. B-104). The EFH EIS finds that fishing habitat-mediated impacts on spawning and breeding are minimal, temporary, or have no effect in the BSAI and are unknown in the GOA. The impacts on growth to maturity are unknown in both the BSAI and GOA (NMFS 2005, pp. B-101, B-105).

Shortraker rockfish: Little is known about the reproductive biology of shortraker rockfish. The 2005 GOA SAFE notes that the fish are presumed to be viviparous, like other *Sebastes* spp., with internal fertilization and incubation of eggs and with the embryos receiving at least some maternal nourishment. There have been no fecundity studies on shortraker rockfish. One study on reproductive biology of the fish indicated they had a protracted reproductive period, and that parturition may take place from early spring through summer (NPFMC 2005d, p. 687). There is little evidence for larval habitat preferences and no information on when juvenile fish become demersal (NPFMC 2005d, p. 688). The EFH/HAPC (NMFS 2005) discussion of rougheye rockfish, summarized above, applies to shortraker rougheye and is not repeated here.

Other rockfish: With limited exceptions, the remaining species of rockfish have not been studied to the same extent as the species listed above. The impacts of fishing activity on breeding, spawning, and growth to sexual maturity for these species are treated here as unknown.

It is not possible to do a quantitative analysis of this topic because of the limited knowledge on this subject, the lack of a simple index of reproductive success, and the lack of a model that would relate TACs and associated fishing activity to changes in reproductive success. A qualitative analysis is provided below, by treating the status quo as the Alternative 2 result, and assuming that increases or decreases in TACs are associated with impact of reproductive success that move in the same direction. No implication about the magnitude of the effects is implied, except in the trivial case of the Alternative 5 harvest strategy, under which any effects would be eliminated.

Table 4-4 summarizes the conclusions with respect to rockfish reproductive success.

Table 4-4 Rockfish reproductive success indicator

	Alternative 1	Alternative 2	Alternatives 3, 4, and 5
Pacific ocean perch	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Impacts on breeding and spawning are likely small; possible habitat-mediated impacts on growth to sexual maturity of unknown strength.	TACs are lower than Alt 2 for all three alternatives in the BSAI and GOA. Therefore, impacts would be reduced.
Northern	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Impacts on breeding and spawning are likely small; possible habitat-mediated impacts on growth to sexual maturity of unknown strength.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Therefore, impacts would be reduced.
Rougheye	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Impacts on breeding and spawning unknown; possible habitat-mediated impacts on growth to sexual maturity of unknown strength.	Rougheye TACs are equal to or less than Alt 2 in GOA, and in the BSAI in 2008. They exceed Alt 2 TACs in the BSAI in 2007 for Alt 3. In absence of a Tier 3 model, Alt 3 TAC is based on average catch in last five years. This exceeds the ABC in 2007, but is less than the OFL. This TAC would not be allowable under the BSAI FMP, and would have to be limited to ABC.
GOA Dusky	Pelagic shelf rockfish Alt 1 and Alt 2 TACs are equal in the GOA. Alt 2 conclusions hold under Alt 1.	Impacts on breeding and spawning are likely small; possible habitat-mediated impacts on growth to sexual maturity of unknown strength.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Therefore, impacts would be reduced.
Shortraker	Alt 1 and Alt 2 TACs are equal in the BSAI and GOA. Alt 2 conclusions hold under Alt 1.	Impacts on breeding and spawning unknown; possible habitat-mediated impacts on growth to sexual maturity of unknown strength.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Therefore, impacts would be reduced.
Other rockfish	Alt 1 and Alt 2 TACs are equal in the BSAI. Alt 1 TACs are higher in the GOA, but still subject to the harvest control rules of the GOA FMP. Alt 2 conclusions hold under Alt 1.	Impacts are unknown.	TACs are equal to or less than Alt 2 for all three alternatives in the BSAI and GOA. Therefore, impacts would be reduced.

Prey availability

There is relatively little information available on the prey of larval or post-larval rockfish. Part of the reason is that it is hard to distinguish larval rockfish. Genetic methods of identifying individual species are available in some cases, but expensive and visual identification is not possible (NPFMC 2005b, p. 599). Euphausiids and copepods are important components of adult rockfish diets. These are also consumed by other groundfish such as pollock. Because of this, alternative pollock policies may affect the availability of these zooplankton to rockfish. Pollock harvest policies that reduce pollock biomass may leave more zooplankton for rockfish, and policies that increase pollock biomass may decrease available zooplankton. As noted below, there is diversity of diets among rockfish species, however, groundfish species don't appear to be important components of rockfish diets.

Pacific ocean perch: The EFH EIS notes that little is known about the diet of planktonic Pacific ocean perch (NMFS 2005, page B-92). The 2005 GOA SAFE notes that Pacific ocean perch are mostly planktivorous. In one study, juveniles were found to feed equally on calanoid copepods and euphausiids. Larger juveniles and adults fed primarily on euphausiids, but also on copepods, amphipods and mysids. In one study in the AI, myctphids have been found to be an increasingly important component of Pacific ocean perch diets. (NPFMC 2005b, p. 527). The 2004 BSAI SAFE notes that Pacific ocean perch prey on copepods, euphausiids, myctophids and other prey. The SAFE reports that a 1997 found that the about 90 percent of the diet of small Pacific ocean perch was calanoid copepods. Larger Pacific ocean perch were found to consume larger proportions of euphausiids and myctophids. (NPFMC 2004a, p. 690)

Northern rockfish: The 2005 GOA SAFE notes that northern rockfish are generally planktivorous. Their main prey in the GOA and AI is euphausiids and calanoid copepods. In the AI, calanoid copepods were the primary feed for juvenile northern rockfish, and euphausiids were the primary prey for larger northern rockfish. The largest northern rockfish preyed on mycctophids and squids. Northern rockfish can also prey on arrow worms, hermit crabs, and shrimp. (NPFMC 2005b, p. 582). The 2004 BSAI SAFE notes that calanoid copepods, euphausiids, and chaetonaths constitute 84 percent of the northern rockfish diet. Smaller northern rockfish tend to consume relatively more calanoid copepods, while larger northern rockfish tend to consume relatively more euphausiids. The largest northern rockfish (over 35 cm) consumed myctophids (11 percent of the diet) and cephalopods (16 percent of the diet; NPFMC 2004a, pp. 761-762).

GOA Dusky rockfish: The 2005 GOA SAFE notes that there is limited information on dusky rockfish diet. There is no information on the diet of larval or post-larval dusky rockfish. Euphausiids appear to be the most important prey for adults. (NPFMC 2005b, pp. 729, 749). The EFH EIS notes that there is no information on dusky rockfish diet in the BSAI. (NMFS 2005, p. B-123)

Rougheye rockfish: The 2005 GOA SAFE notes that there is no information on the food habits of larval or post-larval rougheye rockfish. The diet of Alaska rougheye rockfish is primarily shrimp. Fish species such as myctophids are also consumed. Juvenile rockfish in the GOA also consume smaller invertebrates such as amphipods, mysids, and isopods. (NPFMC 2005b, pp. 643, 657). The EFH EIS reports a study indicating that the diet of larger rougheye contained relatively more fish (such as myctophids, while the diet of smaller rougheye contained relatively more shrimp. (NMFS 2005, p. B-102)

Shortraker rockfish: The 2005 GOA SAFE notes that, while the availability of zooplankton prey for larval and post-larval rockfish may be an important determinant of year class strength, little is really known about larval and post-larval diet. It notes that some juvenile shortraker rockfish in inshore habitat have been found preying on shrimp, amphipods, other crustaceans, mollusks and fish. It notes that adult shortraker rockfish have been found to feed on squid, shrimp, and deepwater fish. (NPFMC 2005b, p. 698). The EFH EIS notes that the diet of BSAI shortraker rougheye was mainly shrimp and squid. It reported on research that found that squid were the most important prey in 1990, while shrimp were the most important in 1993. It also reported on research from AI trawl surveys indicating that small shortraker rockfish consumed relatively more shrimp, and larger shortraker consumed relatively more fish. (NMFS 2005, p. B-102).

Other rockfish: The 2005 GOA SAFE notes that thornyhead rockfish consume shrimp, benthic invertebrates and pelagic zooplankton, and that demersal shelf rockfish consume zooplankton. (NPFMC 2005b, p 835, 794). The 2004 BSAI SAFE notes that the species included in the "other rockfish" category consume zooplankton. (NPFMC 2004a, p. 831) The EFH EIS notes that adult thornyhead rockfish in the GOA prey primarily on shrimp, but also eat small fish, benthic amphipods, and other benthic invertebrates and euphausiids. The EFH EIS noted that in the BSAI, shortspine thornyheads consume fish (cottids, rajidae) and shrimp. Prey items are primarily benthic. The EFH EIS reports on a study indicating that larger shortspine thornyheads eat larger items. (NMFS 2005, pp. B-122, B-125)

Summary: It is not possible to do a quantitative analysis of this topic because of the limited knowledge on this subject. Several linkages between TACs and prey availability to rockfish require more elaboration. A qualitative analysis is provided here, by treating the status quo as the Alternative 2 result, and assuming that increases or decreases in TACs are associated with an impact on prey availability that is greater than or less than the status quo level.

The status quo may have a relatively limited direct impact on prey availability because of a lack of groundfish targets in rockfish diets. Euphausiids and copepods (zooplankton) are key prey species for Pacific ocean perch, northern rockfish, dusky rockfish, and "other rockfish". Invertebrates are key prey for rougheye and shortraker rockfish. Pandalid shrimp are key prey for the adults of these species. Euphausiids, copepods, and invertebrates are not the subject of directed fishery or significant incidental catch in the groundfish fisheries. Harvests of other target groundfish species could have an impact on euphausiids and copepods through changes in the populations of other fish species, such as pollock, that prey on these species.

Table 4-5 summarizes the conclusions with respect to rockfish prey availability.

Table 4-5 Rockfish prey impact summary

	Alternative 1	Alternative 2	Alternatives 3, 4, and 5
Rockfish species	No impact in the BSAI. Increased harvests in the GOA should have little to no direct impact on rockfish prey, but may have an indirect impact by reducing competition for common zooplankton prey items.	Little direct impact because of relatively small importance of groundfish as rockfish prey. Possible indirect impacts from competition between other groundfish species and rockfish for common prey items. Size of indirect impacts is unknown.	If there is little direct impact under Alt 2, these alternatives should have little impact as well. They could be associated with increased competition for common prey items.

Habitat

Groundfish fishing methods that contact the bottom (for example, bottom trawls, longlines, or pots) can modify bottom habitat in ways that may affect the ability of rockfish stocks to sustain themselves. The EFH/HAPC EIS (NMFS 2005) summarized the impacts of fishing activities on the capacity of rockfish habitat to sustain rockfish populations. That analysis is used here to characterize status quo levels of fishing activity on the carrying capacity of the rockfish habitat. The impacts of other alternatives will be characterized in comparison with the status quo. Habitat-related impacts on spawning and breeding behavior, and on growth to sexual maturity, were discussed above, in the section on reproductive success. This section focuses on characterizing the overall impacts on species, as described in the EFH EIS.

Section 4.2.3 of this chapter describing reasonably foreseeable future actions, notes that the Council adopted and NMFS approved measures to provide increased protection to essential fish habitat in the AI and GOA. While these measures tend to protect areas where rockfish fishing was limited in the past, they may prevent future impacts on rockfish habitat, and offer a control by preserving habitat in unfished areas. These measures became effective on July 28, 2006.

Pacific ocean perch: The EFH EIS (NMFS 2005) found that information on stock status does not suggest that the cumulative effects of fishing have impaired the ability of BSAI Pacific ocean perch to produce MSY. The effects of fishing on the habitat of BSAI Pacific ocean perch are rated as either unknown, minimal or temporary. Similarly, in the GOA, the EIS found that overall, the stock status seems to be good compared to the recent past, and it is unlikely that habitat impacts are affecting the stock's ability to maintain MSY in the near future. The effects of fishing on the habitat of Pacific ocean perch are either unknown or negligible (NMFS 2005, pp. B-95, B-101).

The EFH EIS did caution, with respect to both the BSAI and GOA, that regarding growth to maturity, the available literature does indicate that juvenile red rockfish do use living (anemones) and non-living (rocky areas) habitat features, with one specific use being the ability to find refuge from predators. Trawling would be expected to have negative impacts for these life stages, although the extent to which the BSAI Pacific ocean perch stock is dependent upon these habitat features is not well known (NMFS 2005, pp. B-95, B-101).

With respect to the BSAI, the EFH EIS cautioned that finer scale impacts do occur and could be important for stocks such as Pacific ocean perch, which are thought to show population structure on small spatial scales (Withler et al. 2001). Similarly, although the current population level data do not indicate declining trends in spawning biomass or recruitment, it is not clear what effects may have occurred at finer spatial scales (NMFS 2005, p. B-95).

Shortraker/rougheye rockfish: The EFH EIS rated the effects of fishing on the habitat of BSAI and GOA rougheye and shortraker rockfish as either unknown, minimal or temporary. It also noted, in both the BSAI and GOA, that it did not appear that the impacts of fishing were impairing the ability of shortraker or rougheye populations to maintain themselves (NMFS 2005, pp. B-105, B-109). The EFH EIS noted that juvenile rougheye and adults of both species used living and nonliving bottom habitat features subject to bottom trawling. Juvenile rougheye had been observed to use the habitat as a refuge from predators. The EIS noted that trawling would be expected to have negative impacts for these life stages. The estimated percent reduction in living and non-living habitat features in the AI did not exceed 7 percent, and this suggested that impacts on these features were not likely to substantially affect red rockfish (including shortraker and rougheye). However, the EIS cautioned that the percent reduction for hard corals was larger than the overall averages, and that studies have indicated that rougheye rockfish are particularly associated with hard corals. The EIS also cautioned that the extent to which habitat impacts occur at smaller scales and the importance of these impacts to the overall BSAI population are unknown (NMFS 2005, pp. B-105, B-109).

Northern rockfish: The EFH EIS rated the effects on fishing on the habitat of BSAI northern rockfish as either unknown, minimal or temporary. The reduction in living and non-living substrates in areas inhabited by the BSAI northern rockfish (AI deep and shallow habitats) did not exceed 8 percent. Larger reductions were identified for hard corals, but studies have not shown that these were heavily utilized by northern rockfish. In this respect, northern rockfish differed from Pacific ocean perch, shortraker and rougheye rockfish. The EFH EIS noted that trawling might adversely impact the ability of juvenile northern rockfish to use rough and rocky habitat for refuge from predators in both the GOA and BSAI, although the extent to which this would take place was unknown. While adverse population scale impacts were not anticipated, the EFH EIS noted that it was not clear if there were effects at finer spatial scales. In the GOA, it was noted that "current stock status trends show no indications of fishing impacting the ability of the stock to maintain MSY, and there is no evidence to suggest that the potential reductions in living and non-living structure on growth and survival to maturity affects the ability of GOA northern rockfish to fulfill its role in a healthy ecosystem" (NMFS 2005, pp. B-113, B-117-118).

Dusky rockfish: The EFH EIS noted that impacts of fishing on dusky rockfish habitat in the BSAI and GOA were unknown or minimal. It did raise concerns about possible impacts of bottom disturbance on growth to maturity in both the BSAI and GOA, because of potential loss of cover from predators. The EIS noted, in the GOA discussion, that habitat models suggested a potential for large reductions in living substrates and hard coral habitats that dusky rockfish inhabit (NMFS 2005, pp. B-121, B-124). An age-structured model has recently been developed for dusky rockfish and indicates no obvious adverse trends in recruitment or spawning biomass. Data for this model are limited, however, and recruitment in the years prior to 1977 is not known, making long-term effects difficult to detect (NMFS 2005, p. B-121).

Other rockfish species: The EFH EIS provides information on the impacts of fishing on BSAI Shortspine thornyheads (SST) habitat: "…In general, the relationship between habitat and SST survival rates has not been established. Given current information, however, impacts to habitat that may support various life stages of SST are minimal to no effect. The main concern is prey availability to SST. Because epifauna are the main prey items for SST, the impacts to those habitats that support their various life stages are also important. Unfortunately, there are no good data to determine which epifauna are the most important in SST diet along the large area of the BSAI." In the GOA, the EIS also indicated that the impact of fishing on thornyhead rockfish, through the impact on habitat, would be minimal to no effect, due to the small proportion of thornyhead bottom habitat and forage that would be impacted (NMFS 2005, p. B-122).

Table 4-6 summarizes the conclusions about rockfish habitat.

Table 4-6 Rockfish habitat impact summary

	Alternative 1	Alternative 2	Alternatives 3, 4, and 5
Rockfish species	BSAI impacts are the same as the status quo impacts, because status quo fishing activity is already at BSAI optimal yield levels. In the GOA, overall TACs are higher and may lead to more bottom contact by gear. However, most of the increase in GOA TACs is associated with increased flatfish TACs, and halibut PSC limits may not allow flatfish harvests to increase a great deal over status quo levels. This alternative may be associated with some increase in habitat disturbance.	In general, impacts on species at the population level appear to be minimal, temporary, no effect, or unknown. For several species, the impacts of trawl disturbance to habitat used by juveniles for refugia are unknown. For several species there also appear to be uncertainties about effects on a local, rather than a population, scale. The advent of the EFH protection measures in July 2006 may provide some benefits by offering a control unfished area, or habitat refugia, but do not provide protection to areas that have been heavily fished in the past.	The potential for habitat impacts would be reduced under these alternatives, which would be associated with reduced TACs for species caught with non-pelagic trawl gear. Potential for habitat impacts would be eliminated under Alt 5. Quantitative assessments cannot be made.

Spatially explicit TACs for rougheye and shortraker in the BSAI

Alternative 4 includes a provision for setting separate TACs for shortraker and rougheye rockfish in the AI and the EBS. Currently each species is subject to a single TAC throughout the entire BSAI. Assessment authors recommended this breakout in the 2005 SAFE reports (NPFMC 2004a, 2004b).

The 2005 BSAI SAFE report for shortraker and rougheye rockfish recommended that the ABCs be partitioned between the EBS and AI areas as a precautionary measure given uncertainty over stock structure in the BSAI. The report recommended a division of the ABCs between the areas on the basis of biomass occurring in the different areas. It recommended an allocation of 89 percent of the BSAI rougheye rockfish ABC to the AI, and 84 percent of the shortraker rockfish ABC to the AI. The BSAI Plan Team reported,

> For 2006 ABC and OFL, the authors presented separate BS and AI recommendations. Per SSC request, the authors summarized existing genetic analyses. These suggest that the BS and AI represent separate spawning populations for rougheye rockfish, although the results are unclear for shortraker rockfish due to lack of sampling in the Bering Sea. The Plan Team also discussed potential management complications that might arise from area-specific quotas for these species. Given the information available, the Plan Team could not reach consensus on whether to split ABC or OFL by region. At this point, the primary data gaps are less related to biology than to the distribution of fishery catches by area/target and the ability of the management system to deal with very small, area-specific TACs. The Plan Team therefore requests that the authors present additional information on the distribution of fishery catches at the September 2006 Plan Team meeting. In the interim, the Plan Team recommends retaining BSAI-wide ABCs and OFLs for the two species (NPFMC 2005c, p. 21).

The SSC agreed with the Plan Team's recommendation for BSAI-wide ABCs (NPFMC 2005e, p. 23).

Separation of the rougheye rockfish TAC into the BS and AI subareas would be based on the proportion of the available biomass in each subarea. Recent surveys estimate the biomass of BSAI rougheye rockfish as 11 percent in the Bering Sea subarea and 89 percent in the AI subarea, and the estimate of the biomass of BSAI shortraker rockfish as 16 percent in the Bering Sea subarea and 84 percent in the AI subarea. Therefore, a separate rougheye or shortraker rockfish TAC for the AI subarea would not be much lower than the TAC for the BSAI area, and would offer little additional protection for AI rougheye rockfish. Also, the biomass estimate used for BSAI rougheye rockfish is based on the AI survey data. The two years of the Bering Sea slope survey (2002 and 2004) have not been used in the stock assessment due to the short length of this new time series. Basing the BSAI stock assessment on only the AI survey biomass produces more conservative (lower) estimates of rougheye rockfish biomass and TACs.

A separate TAC for Bering Sea subarea rougheye and shortraker rockfish could potentially prevent disproportionate harvesting, but the available data are not sufficient to manage these species in the Bering Sea subarea as a separate stock. As mentioned above, the slope survey time series consists of two years, and very limited age and length composition sampling has occurred for rougheye rockfish on the Bering Sea slope. Because BSAI rougheye rockfish are obtained as incidental catch, setting separate ABCs for the Bering Sea and AI subareas may result in more regulatory discarding. Budget shortfalls made it necessary to cut the 2006 Aleutian Islands trawl survey planned for 2006. If this alternative were adopted, it would be imperative for this survey to occur.

Several management measures are in place to minimize and distribute catch of BSAI rougheye and shortraker rockfish. These species are closed to directed fishing for the entire year and are taken only in association with other directed fisheries. As a result, catch is partitioned consistent with the population distribution described above. In 2004 and 2005, 89 percent and 87 percent, respectively, of the rougheye catch occurred in the AI subarea.

In the AI subarea, rougheye and shortraker rockfish are taken as bycatch in fisheries for Pacific ocean perch, Atka mackerel, Pacific cod, halibut and sablefish. Over the period from 2003 through July 2006, most AI rougheye and shortraker bycatch has been taken in the Pacific ocean perch trawl fishery. The Pacific ocean perch fishery accounted for just over two-thirds of the shortraker and rougheye bycatch during this period. The Atka mackerel and Pacific cod fisheries were the next most important sources of regional bycatch, each accounting for about 8 percent of the AI shortraker and rougheye bycatch (M. Furuness, pers. comm. July 28, 2006). The directed Atka mackerel and Pacific ocean perch fisheries are divided into three separate Aleutian Islands districts. Distribution of the target fisheries also distributes the incidental catch of shortraker and rougheye rockfish. Because these species are not open to directed fishing and the directed fisheries that catch them are distributed by three districts in the Aleutian Island subarea, creation of a separate TAC within the AI subarea for these species may provide little additional protection from localized depletion. Separate TACs could serve to increase discards because NMFS may have to make them prohibited to retention.

Retention rates are set low to discourage intentional targeting within the directed fisheries. For both rougheye and shortraker rockfish, the maximum retention rate is 2 percent in the Atka mackerel fishery and 7 percent in the Pacific ocean perch fishery.

4.2.3 Reasonably foreseeable future actions that may affect the impact of groundfish fishing on rockfish

The following reasonably foreseeable future actions may have a continuing, additive and meaningful relationship to the direct and indirect effects of the harvest strategy alternatives on rockfish. These actions are described in Section 3.2 of this EIS.

Ecosystem-sensitive management

Since 2004, the AFSC has entered into a cooperative interagency research program with ADFG that has provided much of the funding for rockfish research at AFSC. These funds are divided among several divisions within AFSC, including Resource Ecology and Fisheries Management (REFM), Resource Assessment and Conservation Engineering (RACE), and the Auke Bay Laboratory (ABL). Research efforts at the ABL are described at http://www.afsc.noaa.gov/ABL/MarFish/Rockfish.htm . Additionally, some research funds are used for external contracts (e.g. analysis of the genetic structure of rockfish populations by faculty at the University of Alaska, Fairbanks).

In 2006, the Council adopted an important program of area closures and partial closures, meant to provide protection to essential fish habitat in the AI and the EBS. These measures became effective on July 28, 2006 (71 FR 36694, June 28, 2006). The final rule may be found online at http://www.fakr.noaa.gov/frules/71fr36694.pdf. The restrictions on bottom contact gear contained in these protection measures are expected to protect large areas of habitat that are used by rockfish species. The Council has initiated an evaluation of additional essential fish habitat protection measures in the EBS.

Rationalization

The GOA Rockfish Pilot Program proposes to implement a rationalization project in the Central GOA rockfish trawl fishery in 2008 and 2009. The proposed rule for this action was published in the *Federal Register* on June 7, 2006 (71 FR 331040). This is a two-year project which allows harvesters to form voluntary cooperatives and receive an exclusive harvest privilege to groundfish species in the Central GOA. Processors can form associations with inshore harvester cooperatives for exclusive processing opportunities. The program should permit increases in fishing and processing efficiency, while constraining actual fleet or processing consolidation. Provisions for use of PSC may create incentives to conserve on PSC quota use, and make it possible to increase target fishery harvests for a given PSC allocation. Net fishing and processing income should increase to an unknown extent.

Traditional management tools

Future harvest specifications will affect rockfish species fishing mortality. In the summer of 2006, the AFSC contracted with the University of Miami to supply a committee of independent fishery experts to review Alaska's current approach to rockfish stock assessments, and to the current harvest strategy. The committee met with scientists from the AFSC and staff from the NPFMC in June 2006, and delivered its report in late-July.

Dark rockfish were officially recognized as a distinct species from dusky rockfish in 2004 (Orr and Blackburn 2004). In 2005 the Council initiated an analysis of a proposal to remove dark rockfish from the GOA FMP. This would effectively turn management over to the State of Alaska. Stock assessment authors, the GOA Plan Team and the SSC, had recommended removal, assuming that this species inhabits predominantly nearshore shallow water habitats, hence is not well assessed by the offshore GOA trawl survey, and because of concerns that dark rockfish could be locally overfished if it were kept within the TAC for the larger PSR complex. The Council initially reviewed the analysis in April 2006 and requested additional data and the evaluation of additional alternatives. The Council will be briefed on the state of the data and the potential for moving forward with the analysis at the Council's October 2006 meeting (NPFMC 2006).

As part of revising the nontarget species management, the Council has requested that rockfish be used as a test case in applying a new management regime for target and nontarget species. The Non-target Species Committee is developing a rockfish management analysis that describes management issues and alternatives for rockfish species in the BSAI and GOA. The analysis is under Council review so this is not a reasonably foreseeable future action at this time. If the Council takes recommended action, it is likely to provide more protection to rockfish species by improving management.

State, Local, and International Actions

The State of Alaska manages the demersal shelf rockfish commercial fishery off of Southeast Alaska under the provisions of the GOA FMP. The State also manages a recreational fishery for DSR. The impact of removal of dark rockfish from the FMP will depend on subsequent state action to manage the species.

Private actions

Ongoing fishing activity will continue to take rockfish as targets and bycatch. This issue has been discussed above in the future harvest specifications analysis. Modifications of gear and fishing practices may produce methods for harvesting rockfish with less halibut bycatch. This may allow fishermen to harvest a larger proportion of rockfish TACs in some instances. Increasing proportions of the GOA

Pacific ocean perch harvest have been taken with pelagic gear rather than non-pelagic gear in recent years. This may reflect efforts by fishermen to reduce halibut bycatch. (M. Furuness, pers. comm., July 2006)

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4.2.5 Preparer and Persons Consulted

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Chapter 5 Non-Specified Fish Species

5.1 The Non-Specified Species Resource

The non-specified fish species category includes a large number of species, including invertebrates, that are not defined in the BSAI or GOA FMPs as target, other, forage, or prohibited species. Non-specified fish species include jellyfish, grenadiers (a group of deep-sea species related to hakes and cods), starfish, prowfish, smooth lumpsuckers, eels, sea cucumbers, Pacific lamprey, greenling, and Pacific hagfish, among others.

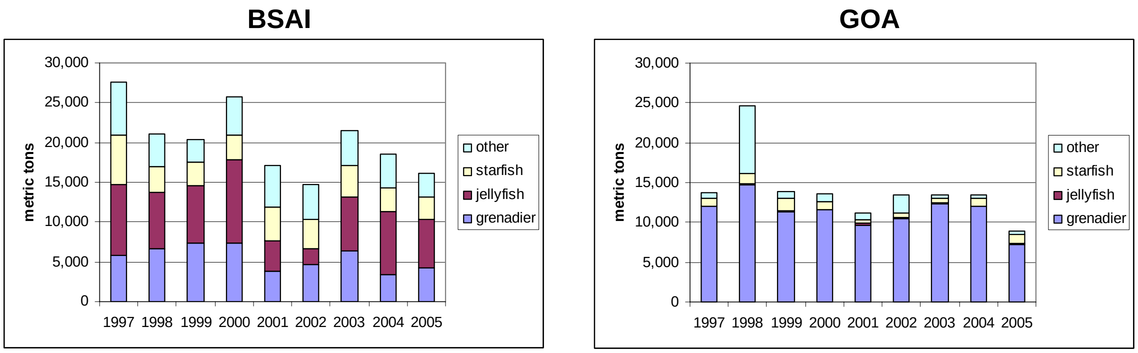
More information on the non-specified species in Alaska's EEZ may be found in several NMFS and Council documents (all links tested in July 2006):

- The 2006 Ecosystems Considerations chapter (Boldt 2005) of the SAFE document reports contain a section on grenadiers. This is available on the internet at http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm .
- Staff at the NMFS Auke Bay Laboratory have prepared a report on the potential for making OFL and ABC estimates for grenadier stocks in the GOA, EBS, and AI (Clausen 2006).
- The 2006 Ecosystems Considerations chapter of the SAFE document contained short reports on non-target fish species. These provide information on a historical jellyfish biomass index for the EBS, and trends in jellyfish CPUE in historical surveys. These are available on the internet at http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm
- The Programmatic Groundfish EIS discusses grenadier, but not other non-specified species, and the impacts of the preferred programmatic FMP alternatives, in Sections 3.5.5 and 4.9.5 (NMFS 2004). The PSEIS is available on the internet at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm .

There is currently no management or monitoring of any species in this category, and the retention of any non-specified fish species is permitted. No reporting is required for any non-specified species, and there are no catch limitations or stock assessments. Most of these fish species are not currently considered commercially important and are not targeted or retained in groundfish fisheries (NMFS 2004, p. 3.5-254)

The information available for non-specified species is much more limited than that available for target fish species. Estimates of biomass, seasonal distribution of biomass, and natural mortality are unavailable for most non-specified species. Management concerns, data limitations, research in progress, and planned research to address these concerns are discussed in Section 5.1.2.6 of the PSEIS (NMFS 2004).

AFSC scientists have developed procedures for making estimates of non-specified species catch from observer reports. Catch estimates for the BSAI and GOA from 1997 to 2005 are summarized in Figure 5.1. The figure shows that BSAI non-specified bycatches have been dominated by jellyfish, grenadiers, and starfish, and GOA bycatches by grenadiers.



Source: Estimates supplied by S. Gaichas, AFSC. “Other” includes other fish, crabs, unidentified invertebrates, seapens and whips, sponges, anemones, tunicates, benthic invertebrates, echinoderms, corals and shrimp. 2005 data through late-October.

Figure 5-1 Estimated annual aggregate annual incidental catch of non-specified species, 1997-2005.

Grenadiers were the subject of a chapter in the 2005 Ecosystem SAFE report (Clausen and Gaichas 2005). Three species of grenadier are taken as bycatch off of Alaska, but most of the catch is believed to be the “giant grenadier” species. While grenadiers are the subject of targeted fisheries in other parts of the world, including New England and the U.S. Pacific Coast, directed fishing for grenadiers hasn’t been successful off of Alaska.

Estimated annual grenadier bycatches from the BSAI and GOA range between 11,400 and 21,300 mt between 1997 and 2005. These bycatches are taken mainly in hook-and-line fisheries. The hook-and-line fisheries with the largest bycatches are the sablefish and Greenland turbot fisheries. Virtually all grenadier bycatches are typically discarded. Discard mortality is 100 percent for these fish, as they do not survive the change in pressure between the deep waters they inhabit and the surface (Clausen 2006). In 2005, two commercial trawl vessels in Kodiak (GOA) explored targeting giant grenadiers, landing approximately 70 mt through August 2005 (T. Pearson, pers. comm.).

Evidence from targeted fisheries in other areas suggests that, because of their long lives and slow growth, grenadier stocks may be especially susceptible to overfishing. Grenadier stocks off of Alaska appear to be large, and probably occupy an important ecological niche. The SAFE notes that, in addition to overfishing concerns, the fishery may be selecting for females. On the other hand, large parts of the grenadier population may live in waters deeper than those normally exploited by hook-and-line operations. Stocks in these waters may act as a reserve to replenish giant grenadier removed by the fishery in shallower water (NMFS 2005, pp. 193-211).

Estimates of giant grenadier biomass for the GOA, EBS, and AI have been made based on trawl and longline survey information from deeper waters. Estimates of mortality and incidental catch back to 1997 are also available. Together, these pieces of information make it possible to project hypothetical Tier 5 and Tier 6 estimates of OFL and ABC for this fishery (The Council has not adopted OFLs and ABCs for grenadier). However, the reliability of the biomass and mortality information is "uncertain" (Clausen 2006). Annual fishing mortality in all years for which this is known is well within the Tier 5 ABC estimates (Clausen 2006); however, as noted, the reliability of the parameters underlying those estimates is uncertain. Biomass is believed to be underestimated to an unknown extent because the population is believed to range deeper than the trawl survey samples, and because some grenadier may occur off the bottom and higher up in the water column (Clausen 2006). Additional discussion of grenadier biology and management can be found in Section 3.5.5.1 of the PSEIS (NMFS 2004).

Over the three year period 2003-2005 most grenadier (over 90 percent) were taken with hook-and-line gear. Most of the remainder are taken with non-pelagic trawl gear. In the GOA, the sablefish fishery is the most important source of incidental catches, accounting for 77 percent of the area total. Hook-and-line flatfish and rockfish account for another 12 percent. Non-pelagic trawl fisheries for rockfish and flatfish together account for another 9 percent of incidental catch. In the BSAI, 96 percent of the grenadiers are taken with hook-and-line gear. Slightly over half of this was in directed hook-and-line fisheries for flatfish, and another third came in the directed fishery for sablefish. (S. Gaichas, pers. comm.)

Much less is known about jellyfish and starfish populations in the GOA and BSAI. The jellyfish population is composed of multiple species. Observer identification of species is difficult. Jellyfish forage on zooplankton (euphausiids and copepods). Zooplankton are also eaten by groundfish species, and there has been some speculation that large jellyfish populations, and the dense aggregations that jellyfish often form, may compete with groundfish for forage. However this remains speculative (K. Aydin, pers. comm.).

The 2006 Ecosystems Considerations report provides a time series of biomass index estimates for large medusae jellyfish (medusae refers to the familiar "adult" body form taken by jellyfish) in the EBS from 1982 to 2005. The index ranged between about 11,000 mt and 23,000 mt between 1982 and 1989. The biomass index generally rose through 2000 and eventually reached a peak of about 337,000 mt. Biomass fell considerably after 2000, and has ranged between about 55,000 mt and 85,000 mt since. The biomass estimate for 2005 was 68,000 mt. (Brodeur 1999; Lauth 2005). A biomass index is not available in the AI, although jellyfish are taken in the AFSC bottom trawl surveys in the AI. In 2004, jellyfish catch rates increased substantially, and were near the highest levels recorded. (Brown 2005). A biomass index is also unavailable in the GOA. Catch per unit effort (CPUE) estimates for jellyfish from AFSC biennial surveys are typically higher for the Central and Eastern GOA than for the Western GOA, and were at their highest levels in 1990 (Martin 2005).

In commercial catches for the period 2003 to 2005, almost all the jellyfish bycatch in Alaska (99 percent) was taken in the EBS. Estimated jellyfish bycatches in the EBS ranged between 6,100 mt and 7,900 mt. Estimated bycatches in the GOA ranged between 27 mt and 213 mt. Pelagic trawling for pollock accounted for about 84 percent of the EBS harvest, and non-pelagic trawling for cod and flatfish accounted for almost all of the rest (S. Gaichas, pers. comm.) Fisheries mortality appears to be a relatively small component of overall mortality (K. Aydin, pers. comm.).

The starfish category is made up of sea stars, including all members of the class Asteriodea, and brittle stars, including all members of the class Ophiura. Sea stars are mobile predators. In shallow water they've been found to feed heavily on bivalves (about 90 percent of their diet); not much is known about their diet in deeper water. Most of the starfish catch is composed of sea stars. From 2003 to 2005, sea star harvests have ranged from about 2,800 mt to about 3,900 mt in the BSAI, and from about 600 tons to about 4,600 tons in the GOA. (K. Aydin, pers. comm.) Fishery harvest appears to be a significant source of mortality for these species. From 2003 to 2005, brittle star harvests appear to have ranged between about 32 and 52 mt in the BSAI, and less than a ton in the GOA. Fishery bycatch appears to be a small source of mortality for this species. (K. Aydin, pers. comm.) However mortality caused by fishing may exceed bycatch mortality; brittle stars are very fragile, and may be easily damaged by bottom trawling. Frequently, all the arms are missing when they come up in a net, and it is likely that mortality among these is high. Moreover, brittle stars are small in size, and may not be retained in a cod end (D. Clausen, pers. comm., July 18, 2006).

Between 2003 and 2005, the non-pelagic trawl fishery for flatfish accounted for about 85 percent of the starfish (sea star and brittle star combined) harvest in the BSAI. Cod hook-and-line gear accounted for another 10 percent, and cod trawl gear accounted for another 3 percent. In the GOA, cod pot gear accounted for almost 70 percent of the starfish harvest. Hook-and-line gear used for Pacific cod accounted for another 20 percent, and flatfish trawling accounted for 8 percent (S. Gaichas, pers. comm. July, 2006).

The impacts of the groundfish specification harvest strategy alternatives on non-specifided species are evaluated using the same indicators used for target species of fish, and for non-specified species of fish. These are catch impacts on (1) mortality, (2) genetic structure of the population, (3) reproductive success, (4) prey availability, and (5) habitat. Genetic structure and reproductive success are measures of the impact of spatial and temporal concentration of fishing on the stocks. These criteria are further discussed in Chapter 4, on target species.

5.2 Impacts of Alternative Harvest Strategies on Non-Specified Species

Fishing activity takes non-specified species, particularly grenadiers, jellyfish, and starfish, as bycatch. As noted above, brittle stars may be vulnerable to damage by bottom trawls, even if they aren't caught by the gear. The PSEIS indicates that bycatches within the range evaluated under the preferred alternative are probably low relative to the population (NMFS 2004, pp. 246-247). Indirect effects include habitat disturbance by fishing gear and disruption of food web interactions by disproportionate removal of one or more trophic levels. Insufficient information is available to estimate the indirect effects of changes in the incidental catch of non-specified species.

In this analysis, experience under the status quo harvest strategy in 2003-2005 has been used to characterize the Alternative 2 strategy. Impacts under other strategies have been evaluated by looking at the changes in TACs, and the implied harvests for the target species that take most of the bycatch species. All other environmental conditions being equal, the impact of the fishery on the bycatch species is assumed to depend on changes in target fishery activity. Except for estimates of bycatch mortality under Alternative 2, the analysis is necessarily qualitative rather than quantitative.

Mortality

- ***Status quo*** *Alternative 2:* Bycatch mortality is estimated below as the range of annual mortality estimates from 1997 to 2005.
  - Grenadier bycatch in the GOA has ranged from 7,200 mt to 14,700 mt in the GOA, and 3,300 mt to 7,400 mt in the BSAI. In both the GOA and the BSAI, grenadier bycatch mortality should be substantially lower than the estimated ABC levels.

- Jellyfish bycatch in the GOA ranged from 30 to 200 mt in the GOA, and 1,900 mt to 10,500 mt in the BSAI.
- Starfish bycatch ranged from 470 mt to 1,500 mt in the GOA, and 2,800 mt to 6,200 mt in the BSAI.
- Other non-specified species bycatch ranged from 350 mt and 8,600 mt in the GOA, and 3,000 mt to 6,800 mt in the BSAI.

- *Alternative 1:* BSAI TACs are equal to Alternative 2 TACs. All non-specified harvests should be similar to the Alternative 2 levels. Most grenadier are taken in the sablefish fishery in the GOA. Under Alternative 1, GOA sablefish TACs are no higher than Alternative 2 TACs; therefore, grenadier bycatch is expected to be at about Alternative 2 levels. Jellyfish bycatches are normally quite small in the GOA. Most GOA starfish bycatch is taken in Pacific cod fisheries. Pacific cod TACs under Alternative 1 are equal to those under Alternative 2.
- *Alternative 3:* The BSAI sablefish hook-and-line fishery accounts for over half of the grenadier fishery bycatch. This TAC drops relative to the status quo in this alternative, therefore grenadier bycatch from this source is expected to drop correspondingly. This may be offset by an increase in the Greenland turbot TAC, since the Greenland turbot fishery is another important source of grenadier harvest. This TAC is expected to be higher under this alternative. Pollock TACs are 20 percent lower in this alternative than under Alternative 2. This should lead to a reduction in jellyfish bycatch. In the BSAI, flatfish trawling accounts for most of the starfish bycatch. Flatfish TACs are considerably lower under Alternative 3 than under the status quo, suggesting that, all other things equal, starfish bycatch may decline by an unknown amount. GOA sablefish TACs are somewhat lower than Alternative 2 levels; therefore, the range of likely GOA grenadier bycatch is shifted downward somewhat by this alternative. Jellyfish bycatches are normally quite small in the GOA. GOA starfish bycatch comes mainly from Pacific cod fisheries. The Pacific cod TAC increases under this alternative; therefore, starfish bycatch may increase relative to the status quo.
- *Alternative 4:* BSAI sablefish and Greenland turbot TACs are at Alternative 2 levels under this alternative. Therefore grenadier bycatch is expected also to be at Alternative 2 levels. Pollock TACs are about a third lower in this alternative than under Alternative 2. This should lead to a reduction in jellyfish bycatch. Starfish are taken mainly in the flatfish fisheries. Flatfish TACs tend to be lower than status quo TACs in the second year under this alternative. Therefore, there may be a decline in starfish bycatch. GOA sablefish TACs are equal to Alternative 2 levels. Therefore, grenadier catches are expected to be at about Alternative 2 levels in the GOA. Jellyfish bycatches are normally quite small in the GOA. GOA starfish bycatch is taken primarily in GOA Pacific cod fisheries. Since Pacific cod TACs drop under this alternative, starfish bycatch is expected to drop as well.
- *Alternative 5:* There is no non-specified bycatch mortality associated with this alternative.

Genetic structure of the population

- ***Status quo*** *Alternative 2:* Little is known about the genetic structure of the non-specified species populations, or about the impact of status quo harvest strategy fishing levels on them.
- *Other alternatives:* The direction of change from the status quo alternative harvest strategy is expected to follow the patterns discussed for mortality.

Reproductive success

- ***Status quo*** *Alternative 2:* Little is known about the determinants of reproductive success for the non-specified species populations, or about the impact of status quo harvest strategy fishing levels on them.
- *Other alternatives*: The direction of change from the status quo harvest strategy is expected to follow the patterns discussed for mortality.

Prey availability

- ***Status quo*** *Alternative 2:* Little is known about the prey needs of the non-specified species populations, or about the impact of status quo harvest strategy fishing levels on them.
- *Other alternatives:* The direction of change from the status quo harvest strategy is expected to follow the patterns discussed for mortality.

Habitat

- ***Status quo*** *Alternative 2:* Little is known about the habitat needs of the non-specified species populations, or about the impact of status quo harvest strategy fishing levels on them. Bottom contact gears may affect the shallower ranges of grenadier habitat. An unknown and perhaps substantial portion of the grenadier habitat occurs in areas beyond the range of current fishing activities, and is not affected. Fishing probably has relatively little impact on jellyfish habitat, as jellyfish occupy the water column. The impact on starfish habitat is not known.
- *Other alternatives:* The direction of change from the status quo harvest strategy is expected to follow the patterns discussed for mortality.

Table 5-1 Summary of impacts on non-specified species

		A1	A2	A3, A4, and A5
Mortality		Little or no increase in mortality relative to status quo for this alternative.	Grenadier incidental catch mortality (11,400-21,300 mt) is expected to be significantly less than the sum of BSAI and GOA Tier 5 ABC projections. Jellyfish: 6,300-10,500 mt Starfish:3,800-7,200 mt. Possible brittle star incidental mortality not accounted for.	Expect declines in mortality from Alt 2 levels, as TACs for target species taking non-specified bycatch are reduced. Magnitude of impacts unknown for A3 and A4. No mortality with A5.
Spatial and temporal impacts	**Genetic structure of population**	Expect little change in impact compared to status quo.	Genetic impacts are unknown. Harvest of grenadiers is small compared to biomass.	Genetic impacts are unknown, but probably smaller than A2 levels. No impacts under A5.
	Reproductive success	Expect little change in impact compared to status quo.	Reproductive impacts are unknown.	Reproductive impacts are unknown, but probably smaller than A2 levels. No impacts under A5.
Prey		Expect little change in impact compared to status quo.	Prey impacts are unknown	Prey impacts are unknown, but probably smaller than A2 levels. No impacts under A5.
Habitat		Expect little change in impact compared to status quo.	Habitat impacts are unknown.	Habitat impacts are unknown, but probably smaller than A2 levels. No impacts under A5.

5.3 Reasonably Foreseeable Future Actions that may Affect the Impact of Groundfish Fishing on Non-Specified Species

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on non-specified species.

Ecosystem-sensitive management

Increased ecosystem research should lead to increased attention to the impact of fishing activities on non-target resource components, including non-specified species. In April 2005, the Council requested that grenadiers and other non-specified species be included in a study to evaluate separate harvest specifications for the species in the "other species" complex ("other species" included sharks, skates, octopus, squids and sculpin). Additional information is available in the Council's April 2005 Newsletter, p. 5, at http://www.fakr.noaa.gov/npfmc/newsletters/newsletters.htm. In October 2006, the Council's SSC is scheduled to review an action plan for analysis of separate management for groups within the "other species complex. Staff at the ABL have made preliminary estimates of OFLs and ABCs for grenadiers. Council specification of OFL, ABC, and TAC levels for grenadier would make it possible for in-season managers to make grenadiers a prohibited species once the TAC was taken, and to begin to close target fisheries taking grenadier as bycatch, or impose other restrictions, as the OFL was approached. This may create difficult interactions with the sablefish IFQ fishery, since the sablefish fishery is responsible for a large proportion of the grenadier bycatch.

Rationalization

Rationalization actions do not appear to interact meaningfully with non-specified species issues. Rationalization of a fishery that took grenadiers might slow the fishery down and permit marketing of the catch. However, most grenadiers are taken in the hook-and-line sablefish fishery, which is already rationalized under an individual quota program.

Traditional management tools

Future harvest specifications will affect non-specified species fishing mortality. Aggregate TAC in target fisheries is used as the proxy for direct and indirect fishery impacts. BSAI groundfish TACs are equal to the maximum OY level, and unlikely to increase further unless the statutory OY is relaxed. The bulk of the non-specified harvest in the GOA appears to be grenadiers, taken as incidental catch in the sablefish fishery.

Private Actions

Ongoing fishing activity from 2008 to 2015 will continue to take non-specified species as bycatch. This issue has been discussed above in the future harvest specifications analysis. Note, however, that grenadiers are the subject of targeted fisheries elsewhere, and were the subject of an experimental harvest in the GOA in 2005. If a directed fishery for grenadiers should develop and environmental concerns exist, an emergency rule could be used to constrain harvests. A directed fishery cannot be considered reasonably foreseeable at this time.

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5.5 Preparer and Persons Consulted

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Chapter 6 Forage Fish

6.1 The Forage Fish Resource

The GOA and BSAI FMPs define forage fish species as

> those species…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 (NPFMC 2005a, p. 11; 2005b, p. 11).

Some species, identified as target and prohibited species in the FMPs, such as juvenile pollock and herring, are also important forage for many marine mammal, seabird, and fish species. However, in this chapter, the analysis focuses on the species identified as forage fish in the GOA and BSAI FMPs. Forage fish species in the FMPs include, but are not limited to, eulachon, capelin, other smelts, lanternfishes, deepsea smelts, Pacific sand lance, Pacific sandfish, gunnels, pricklebacks, bristlemouths, and krill.[11]

More information on the forage fish in Alaska's EEZ may be found in several NMFS and Council documents (all links tested in July 2006):

- The Council's Fishery Management Plans for the BSAI and GOA include discussions of forage species. As noted above, the FMPs define the species groups. Section 4.2.2 in each document describe essential forage fish habitat. Appendix D in each document provides some information on forage fish life history (NPFMC 2005a, 2005b). The FMPs are on the internet at: http://www.fakr.noaa.gov/npfmc/default.htm .
- Sections 3.5.4 and 4.9.4 of the Programmatic Supplemental Groundfish EIS discuss forage fish and the impacts of the preferred programmatic FMP alternatives (NMFS 2004). The groundfish PSEIS is on the internet at: http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm .

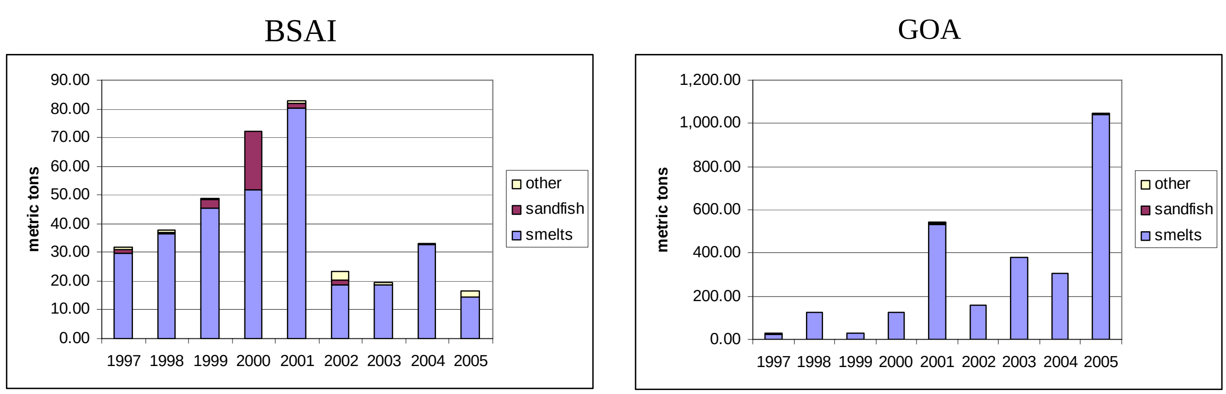
[11] Under the FMPs, the forage fish category includes fish in the families Osmeridae, Myctophidae, Bathylagidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae, and the order Euphausiacea.

- The Essential Fish Habitat/Habitat Areas of Particular Concern EIS and EA describe the forage fish species in the GOA and BSAI in Section 3.2.4.2. Appendix Section B.3.4 describes the impacts of fishing on essential fish habitat for forage species (NMFS 2005). The EFH EIS is on the internet at: http://www.fakr.noaa.gov/habitat/seis/efheis.htm .
- The 2005 GOA SAFE report (NPFMC 2005c) has an appendix on GOA forage fish species (Conners and Guttormsen 2005). The 2005 GOA SAFE report can be found on the internet at http://www.afsc.noaa.gov/refm/stocks/assessments.htm .
- The SAFE Ecosystem Considerations Chapter for 2006 report has a section on forage fish. (Boldt 2005, pp. 116–126). This can be found on the internet at http://access.afsc.noaa.gov/reem/ecoweb/EcoChaptMainFrame.htm .

Regulations at 50 CFR 679.20(i) prohibit directed fishing for forage fish species. The sale of forage fish species is limited to fish retained under the MRA, which may be made into fishmeal. An aggregate MRA for forage fish species has been set at 2 percent of the directed target fishery retained catch (Tables 10 and 11 to 50 CFR 679).

Aggregate catches of forage fish species can be estimated from observer data. Figure 6.1 summarizes AFSC estimates of aggregate forage fish species catch by year and species for the BSAI and GOA from 1997 to 2005. Almost all the GOA forage fish incidental catch, and most of the BSAI incidental catch, consists of smelts (Family Osmeridae, including capelin, eulachon, and other smelts). Significant volumes of sandfish were also taken in the BSAI fishery, but only in 2000. BSAI incidental catch of forage fishes ranged from just over 20 mt to just over 80 mt per year. BSAI smelt harvests appear to be lower in recent years. The GOA incidental catch was generally less than 400 mt, but in one year it was more than 500 mt, and in 2005 it was more than 1,000 mt. GOA smelt bycatch appears to be larger in recent years.

Figure 6-1 Estimated aggregate annual incidental catch of forage fish species, 1997-2005



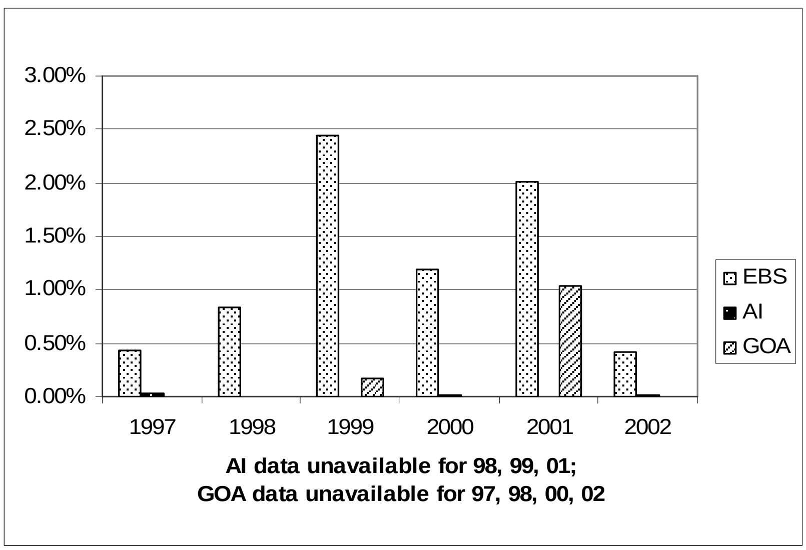
Source: Estimates supplied by S. Gaichas, AFSC. 2005 data through late October.

Most of this incidental catch is taken by pollock trawlers. In the GOA, where most of the forage fish harvest is taken, pollock trawling accounted for 97 percent of the smelt harvest in the 3-year period from 2003-2005. In the BSAI, where forage fish harvests are much smaller, pollock trawlers accounted for about two-thirds of the bycatch, and non-pelagic flatfish trawling accounted for about one-third.

Estimates of biomass and seasonal distribution of biomass are poor for forage fish species. Bottom trawl surveys of groundfish conducted by NMFS are not designed to assess the biomass of forage fish species. Several important forage fish species are pelagic (capelin, eulachon, smelts) and appear in bottom trawls only sporadically. All four species tend to be small bodied and are not fully retained by the meshes of either survey or commercial trawl gears. The PSEIS notes that there is some evidence that smelt biomass has been at relatively low levels during the last 20 years (NMFS 2004, p. 247).

The available information on biomass indicates that fishing rates on capelin and eulachon, which account for most forage fish catch, are low. Nelson estimates that smelt incidental catch in the central GOA, the region with the vast majority of GOA smelt bycatch, was probably less than 1 percent of the biomass in 1999 and 2001 (NPFMC 2003, p. 763). The PSEIS indicates that incidental catches of forage fish within the range evaluated under the preferred alternative bookends are probably very low with respect to the forage fish populations (NMFS 2004, pp. 246-247). This is also indicated by Figure 6-2 below, which shows smelt bycatch by management area as a percentage of the estimated management area's eulachon biomass (note that Figure 6-2 does not include 2005, a year with relatively high smelt bycatch in the GOA).

Figure 6-2 Smelt bycatch as a percentage of estimated eulachon biomass



Source: data supplied by M. Sigler, September 22, 2005.

Based on biomass estimates prepared from bottom trawl surveys, it appears that in a typical year, exploitation rates are 2.2 percent or less. Because smelts are pelagic, biomass estimates based on trawl data are believed to be low, so that true exploitation rates may be even lower. More accurate biomass estimates prepared from echo-integration survey data suggest that biomass estimates based on bottom trawl survey data may underestimate by a factor of 20. Estimates based on food web modeling also suggest that biomass estimates from bottom trawl surveys are biased low (NPFMC 2005).

Ecopath food web models suggest that arrowtooth flounder, pollock, and squid are the three top predators of both capelin and eulachon (NPFMC 2005c, Chapter 16, Figure 16.7).

Juvenile pollock compete with capelin for food, and adult pollock are important predators of capelin. Because of this, indirect effects of pollock harvest of forage fish may occur, but their exact nature is impossible to predict.

An analysis of available GOA forage fish information was prepared as an appendix to the 2005 SAFE reports (Conners and Guttormsen 2005). No new information has been made available since that time (E. Conners, pers. comm., July 2006).

6.2 Impacts of Alternative Harvest Strategies on Forage Fish

The impacts of the groundfish specification harvest strategy alternatives on forage fish are evaluated using the same indicators used for target and non-specified species of fish. Catch impacts are evaluated on the following factors: (1) mortality, (2) genetic structure of the population, (3) reproductive success, (4) prey availability, and (5) habitat. Genetic structure and reproductive success are measures of the impact of spatial and temporal concentration of fishing on the stocks, as discussed in Chapter 4, on target species.

For the purpose of this analysis, most impacts of the target fishery harvest strategies on forage fish, which is predominately smelts, will be assumed to be proportional to the pollock harvest. Smelt bycatch is currently believed to be small in relation to the biomass, so a large proportionate change in pollock harvests would be necessary to impact the biomass. Bottom contact gear activity may be important for habitat impacts for benthic species such as sand lance.

Mortality

- ***Status quo*** *Alternative 2*: Almost all forage fish bycatch mortality is capelin and eulachon (smelt species), taken as bycatch in pollock fisheries. Bycatches in recent years have been between 30 mt and 80 mt in the BSAI, and 23 mt to 1,000 mt in the GOA. Status quo fishing rates in the BSAI and GOA are believed to be very low, on the order of 1 percent or less of smelt biomass. Under the status quo harvest strategy, BSAI pollock TACs may decline significantly by 2008, potentially further reducing forage fish mortality and mortality rates. As noted above, pollock compete with smelts for food, and are important smelt predators. Therefore, pollock harvests may have an unpredictable indirect impact on smelt mortality.
- *Alternative 1*: BSAI pollock TACs are equal to Alternative 2 levels under this alternative, while GOA TACs are on the order of 13 percent to 18 percent higher. This alternative may lead to a small increase in forage fish catches in the GOA, but the Alternative 1 bycatch is still expected to be small in relation to GOA biomass.
- *Alternative 3:* This alternative is associated with reduced pollock TACs and therefore, with reduced forage fish catches and fishing mortality rates. Since status quo mortality is already quite small, a shift to this alternative should not have a big impact on forage fish stocks.
- *Alternative 4:* This alternative is associated with a reduction in pollock TACs compared to the status quo and therefore would reduce forage fish catches and fishing mortality rates. Since status quo mortality is already quite small, a shift to this alternative should not have a big impact on forage fish stocks.
- *Alternative 5:* No mortality would be imposed on forage fish. However, given the small status quo fishing mortality rate, this should not have a big impact on forage fish stocks.

Genetic structure of the population

- ***Status quo*** *Alternative 2:* No information is available on the genetic structure of forage fish stocks. Regulations disperse the pollock fishery in space and time. This, combined with the low forage fish mortality rate believed to be associated with status quo levels of harvest, suggest that groundfish fishing is having a small impact on the genetic structure of forage fish populations.
- *Alternative 1:* This alternative is associated with somewhat larger pollock harvests in the GOA (on the order of 13 percent to 18 percent above status quo levels), but not in the BSAI. As noted above, status quo fishing mortality rates are low. For this reason, current harvest rates are not believed to have an important impact on forage fish stock genetic structure. Even with an increase in pollock harvest of this magnitude, the mortality rate would remain low, and there may be little impact on genetic structure.
- *Alternative 3:* Smaller pollock harvests may reduce capelin and eulachon harvests. However, status quo harvests are already small, and not believed to be having an impact on stock genetics. This alternative would also have little impact.
- *Alternative 4:* Under this alternative, pollock catches would be cut. Smaller pollock harvests may reduce capelin and eulachon harvests. However, status quo harvests are already small, and not believed to be having an impact on stock genetics.
- *Alternative 5:* In the absence of fishing activity, there would be no fishing mortality related stock impacts. However, status quo fishing is not believed to have a big impact on genetic structure, so a shift to this alternative may not have a big impact on the genetic structure of forage fish stocks.

Reproductive success

- ***Status quo*** *Alternative 2:* Many forage fish species spawn in shallow, intertidal, or river waters; others are broadcast spawners and their eggs are pelagic. Regardless of their spawning method, groundfish fishing is expected to have little impact on the spawning, nursery, or settlement habitat of forage fish species. The EFH/HAPC EIS describes the impact of fishing activity on forage fish spawning habitat as having minimal, temporary, or no effect (NMFS 2005, pp. 128-135). This, combined with low harvest rates, may mean that groundfish fishing under the status quo has little impact on reproductive success.
- *Alternative 1:* Pollock catches would be on the order of 13 percent to 18 percent higher than the status quo in the GOA under this alternative, and no higher in the BSAI. As noted, because of low fishing rates and limited groundfish fishing in many inshore spawning areas, the status quo is not expected to have an important impact on forage species reproductive success. The increases in pollock harvest in the GOA may increase impacts on forage fish somewhat, but the incremental impacts are expected to represent a small change to a small existing impact.
- *Alternative 3:* Pollock fishing would be lower than the status quo under this alternative. However, given the limited impact on reproductive success under the status quo, this alternative would be expected to have a limited impact itself, and to have an impact not dissimilar to that under the status quo.
- *Alternative 4:* Pollock fishing would be reduced from the status quo under this alternative. However, given the limited impact on reproductive success under the status quo, this alternative would be expected to have a limited impact itself, and to have an impact not dissimilar to that under the status quo.
- *Alternative 5:* There would be no pollock fishing under this alternative. However, given the limited impact on reproductive success under the status quo, this alternative would be expected to have a limited impact itself, and to have an impact not dissimilar to that under the status quo.

Prey availability

- ***Status quo** Alternative 2:* Most forage fish feed on copepods and euphausiids which are unlikely to be directly affected by groundfish fishing, or they feed in shallow water where there is relatively little fishing activity. In general, there is likely to be little direct impact of fishing activity of forage fish prey availability. One possible direct impact is on sand fish which feed on small fish near the bottom in areas of potential fishing activity. The impact of fishing on sand fish prey is not known (NMFS 2005, pp. 128-135). While direct impacts of this alternative generally appear to be small, there may be some more complicated indirect impacts. Capelin are believed to directly compete for prey with juvenile pollock. Fishing induced declines in numbers of small pollock may increase available capelin prey. (E. Conners, pers. comm.) However, the size of the pollock fishing impact on capelin prey, and even its direction, are not known. The pollock fishery harvests adult pollock, which themselves prey on juvenile pollock. Thus, pollock harvests may increase prey for capelin by reducing pollock stock sizes, or may reduce prey by reducing the stock of predators of juvenile pollock.
- *Alternative 1:* BSAI harvests would be similar to those under status quo; GOA harvests would be somewhat higher (estimated 13 to 18 percent higher). The impact on forage fish prey is likely to be small; however, the impact on sand fish is not known.
- *Alternative 3:* BSAI and GOA pollock harvests would be somewhat lower under this alternative than under the status quo. The impact on forage fish prey is likely to be small; however, the impact on sand fish is not known.
- *Alternative 4:* BSAI and GOA pollock harvests would be lower under this alternative than under the status quo. The impact on forage fish prey is likely to be small; however, the impact on sand fish is not known. Indirect effects may be substantial, but are impossible to predict.
- *Alternative 5:* Under this alternative, there would be no pollock harvest. The impact of forage fish prey is likely to be small; however, the impact on sand fish is not known.

Habitat

- ***Status quo** Alternative 2:* Forage fish are primarily pelagic, using shallow waters, intertidal zones, and rivers for spawning habitat. In general, the EFH EIS (NMFS 2005) finds that habitat impacts from fishing activity have minimal, temporary, or no effect on forage fish. However, Pacific sandfish have demersal juvenile and adult life stages. The EFH EIS describes them as "ambush predators that lay in wait for prey buried under the sand." The impact of bottom contact gear on sandfish is not known (NMFS 2005, pp.128-135).
- *Alternative 1:* BSAI harvests would be similar to those under the status quo; GOA harvests would be somewhat higher. There would be little impact on the habitat of most forage fish species. The potential for impact on sand fish habitat is higher, but it is not known if the status quo impact is important, or how much the Alternative 1 impact would be.
- *Alternative 3:* BSAI and GOA harvests are somewhat lower under Alternative 3 than under the status quo. There would be little change in the impact on the habitat for most forage species. The potential for impact on sand fish habitat is higher, but it is not known if the status quo impact is important, or how much less the Alternative 3 impact would be.
- *Alternative 4:* BSAI and GOA harvests are lower under Alternative 4 than under the status quo. There would be little change in the impact on the habitat for most forage species. The potential for impact on sand fish habitat is higher, but it is not known if the status quo impact is important, or how much less the Alternative 4 impact would be.
- *Alternative 5:* There would be no groundfish harvests under this alternative. There would be little change in the impact on the habitat for most forage species. There is no potential for impact

on sand fish habitat, but it is not known how much less this would be than under the status quo, or whether it would have an important impact on sand fish.

Table 6-1 below summarizes the impacts of the alternative harvest strategies on forage fish.

Table 6-1 Summary of impacts on forage fish

		A1	A2	A3, A4, A5
Mortality		Bycatch mortality rate low.	Bycatch believed small compared to biomass.	Smaller impact than status quo.
Spatial and temporal impacts	**Genetic structure of population**	genetic impacts under this alternative are believed to be small.	Impacts are believed to be small.	Smaller impact than status quo.
	Reproductive success	reproductive success impacts under this alternative are believed to be small.	Impact is believed to be small.	Smaller impact than status quo.
Prey		Impacts are expected to be small. Sand fish may be an exception; the impact on sand fish is unknown.	Impacts are expected to be small. Sand fish may be an exception; the impact on sand fish is unknown.	Smaller impact than status quo.
Habitat		In general, impacts are expected to be small. Impact on sand fish is unknown.	In general, impacts are expected to be small. Impact on sand fish is unknown.	Smaller impact than status quo.

6.3 Reasonably Foreseeable Future Actions that may Affect the Impact of Groundfish Fishing on Forage Fish

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the harvest strategy alternatives on forage fish.

Ecosystem-sensitive management

Ecosystem research and increasing attention to ecosystem issues, should lead to increased attention to the impact of fishing activity on non-target resource components, including forage species. This is likely to result in reduced adverse impacts. AFSC scientists are developing procedures for more accurate GOA capelin biomass estimates based on acoustic surveys. It may be possible to make these estimates within one to two years. Research is also continuing on using acoustic survey information to make biomass estimates of eulachon, but this work is not as advanced (E. Conners, pers. comm., June 13, 2006).

Traditional management tools

Future harvest specifications will affect forage species fishing mortality. Pollock trawl incidental catches of smelt appear to be the main source of groundfish fishery mortality on forage stocks. Thus, future harvests in some years may be larger and may have a greater impact on smelts than the harvests projected in this action.

Private actions

Ongoing fishing activity will continue to take forage fish species as bycatch. Ongoing economic development of coastal Alaska, and increasing levels of marine transportation activity may interact adversely with populations of forage fish species. Development that may impact coastal and riverine spawning habitat may have the greatest potential for affecting these populations. However, development in Alaska remains small compared to development in other coastal states. Subsistence harvests of eulachon ("hooligan") occur in Alaskan waters.

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6.5 Preparer and Persons Consulted

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Chapter 7 Prohibited Species

7.1 The Prohibited Species Resource

Prohibited species in the groundfish fisheries include all Pacific salmon species and stocks (Chinook, coho, sockeye, chum, and pink), steelhead trout, Pacific halibut, Pacific herring, and Alaska king crab, Tanner crab, and snow crab.

The most recent information on the life history, stock assessment, and management of the directed fisheries targeting these species in Alaska may be found at the following websites:

- Alaska Department of Fish and Game: http://www.adfg.state.ak.us
- International Pacific Halibut Commission: http://www.iphc.washington.edu
- 2005 SAFE report for the king and Tanner crab fisheries in the BSAI (NPFMC 2005b): http://www.fakr.noaa.gov/npfmc/SAFE/SAFE.htm.

The effects of the groundfish fisheries in the BSAI and GOA on prohibited species are primarily managed by conservation measures developed and recommended by the Council over the entire history of the FMPs for the BSAI and GOA and implemented by Federal regulation. These measures can be found at 50 CFR 679.21 and include prohibited species catch (PSC) limitations on a year round and seasonal basis, year round and seasonal area closures, gear restrictions, and an incentive plan to reduce the incidental catch of prohibited species by individual fishing vessels.

These management measures are further discussed in the following documents:

- The GOA and BSAI FMPs define the prohibited species, and create the management framework for them. Sections 3.6.1 and 3.6.2 in each FMP cover management. The FMPs are available on the Council's web site at http://www.fakr.noaa.gov/npfmc/default.htm.
- The final EIS for EFH (NMFS 2005a), is available online at http://www.fakr.noaa.gov/habitat/seis/efheis.htm.
- Section 3.5 of the PSEIS (NMFS 2004a) reviews the status of prohibited species and the effects of the groundfish fisheries on them at http://www.fakr.noaa.gov/sustainablefisheries.seis/intro.htm.

- A review paper by Witherell and Pautzke (1997) entitled, "A Brief History of Bycatch Management Measures for Eastern Bering Sea Groundfish Fisheries," is available at http://www.fakr.noaa.gov/npfmc/sci_papers/MFR.pdf.
- The effects of the groundfish fisheries on crab are discussed in the EIS for BSAI Crab Fisheries (NMFS 2004b) available at http://www.fakr.noaa.gov/sustainablefisheries/crab/eis/index.htm .
- The Council has prepared a draft EA/RIR/IRFA for proposed Amendment 84 to the BSAI FMP to modify the existing Chinook and chum savings areas in the BSAI (NPFMC 2005a). This document contains the most recent information on the status of salmon stocks in the BSAI and the impacts of the BSAI groundfish fishery on salmon stocks in the BSAI. The draft is online at http://www.fakr.noaa.gov/npfmc/current_issues/bycatch/salmonbycatch_1005.pdf.
- As part of an ongoing ESA consultation NMFS has prepared an "Assessment of ESA-listed Salmon and Steelhead Interactions with the Alaska Groundfish fisheries" (NMFS 2006b). The most recent up-to-date submission is online at http://www.fakr.noaa.gov/analyses/salmon/bsaiamd84section7.pdf.

Table 7-1 presents the total catch of groundfish by target, area, and gear, and the prohibited species catch that was incidental to those groundfish fishing activities from 1999 to date in 2006. Tables 7-2 through 7-9 summarize information on PSC bycatch by gear type, and by the GOA and BSAI management areas in 2005. Tables 7-2 through 7-5 contains information on the BSAI include the groundfish catch and associated prohibited species incidental catch in the CDQ fisheries. CDQ allocations are based on 10 percent of the annual pollock TAC and 7.5 percent of other target species TACs in the BSAI. Proportionate shares of the PSC limits are also allocated to the CDQ fisheries in the BSAI.

Steelhead trout

Only one steelhead trout has been observed taken in the groundfish fisheries. No specific management measures to prevent bycatch of steelhead trout exist beyond the prohibited retention that applies to all prohibited species under 679.21(b)(4). Because of the extreme rarity of occurrence, any potential effect of the groundfish fisheries on steelhead trout is likely very insignificant and will not be further analyzed.

Pacific salmon

Pacific salmon are managed by the State of Alaska on a sustained yield principal. Predetermined escapement goals for each salmon stock are monitored on an inseason basis to insure long term sustainable yields. When escapement levels are low, commercial fishing activities are curtailed. If escapement levels exceed goals, commercial fishing activities are enhanced by longer open seasons. In instances where minimum escapement goals are not met, recreational and subsistence fishing activities may also be curtailed.

The effect of the groundfish fisheries on Pacific Northwest salmon and ESA-listed salmon is limited to incidental take during groundfish harvest. There is no designated critical habitat for ESA-listed salmon in the EEZ. The potential impacts of implementation of Steller sea lion protection measures on ESA-listed salmon was determined to be insignificant in the Steller sea lion protection measures SEIS (Section 4.6.4, NMFS 2001). Additional information is available on the effects of the groundfish fisheries on Pacific Northwest and ESA-listed salmon, and can be found in Section 3.4 of the PSEIS (NMFS 2004a) and in the biological assessment for ESA-listed salmon (NMFS 2006b).

Regulations at 50 CFR 679.21 limit the incidental catch of Chinook salmon to no more than 29,000 fish annually in Bering Sea and 700 Chinook salmon in the Aleutian Islands. Exceeding the limits would result in closure of the Chinook Salmon Savings Areas (CSSAs) of the BSAI to trawl vessels targeting pollock during certain times of the year. Regulations also establish a non-Chinook salmon limit of 42,000 fish for all trawl vessels in the CVOA August 15 through October 14. The Chum Salmon Savings Area is closed by regulation regardless of incidental catch from August 1 through August 31 (50 CFR 679.22). Non-Chinook salmon taken are nearly all chum salmon. Exceeding the non-Chinook limit would result in the Chum Salmon Savings Area being closed to all trawl vessels from September 1 through October. 14

Recent historical incidental catches of salmon and groundfish harvest in the groundfish fisheries (1999-2006) by gear type are presented in Table 7-1. Chinook salmon incidental catch in 2006 (through July 15) is estimated to be 63,144 fish in the BSAI groundfish fisheries, of that amount 97 percent were taken in the pollock fishery. The CSSAs closures were triggered on February 15, 2006. This is the first time the CSSAs closed during the pollock A season in the BSAI. In 2005 and 2004, the CSSAs were closed September through December 31. Catch of “other” salmon through July 15, 2006 is estimated to be 132,334 in the BSAI groundfish fisheries, of that amount 99 percent were taken in the pollock fishery. Chinook salmon incidental catch in the GOA fisheries in 2006 (through June 24) is estimated to be 10,012 fish, of that amount 73 percent were taken in the pollock fishery. Other salmon incidental catch in the GOA fisheries is estimated to be 270 fish, none of which occurred in the pollock fishery.

In 2005 the 42,000 non-Chinook salmon PSC limit in the Catcher Vessel Operating Area (CVOA) was exceeded by 11,884 fish. The exceedence occurred near mid October and therefore the Chum Salmon Savings Area closure was not implemented (M. Furuness, pers. comm., August 9, 2006).

Table 7-1 Incidental Catch of Salmon in the BSAI Groundfish Fisheries, 1999 through the first five months of 2006 (includes CDQ fisheries).

Year	Gear Type	Groundfish (mt)	No. Chinook salmon	No. “other” salmon (primarily chum)
2006 (through July 15)	Trawl	1,051,930	63,133	132,311
	Hook and Line	65,140	10	22
	Pot Gear	14,702	0	0
	Jig	71	0	0
	TOTAL	1,131,843	63,144	132,334
2005	Trawl	1,814,271	72,628	703,061
	Hook and Line	147,248	55	93
	Pot Gear	19,077	0	0
	Jig	124	0	0
	TOTAL	1,980,720	72,683	703,155
2004	Trawl	1,816,853	62,407	456,674
	Hook and Line	124,077	64	211
	Pot Gear	18,356	0	0
	Jig	215	0	0
	TOTAL	1,959,501	62,471	456,885
2003	Trawl	1,807,391	54,898	197,032
	Hook and Line	138,441	13	59
	Pot Gear	23,594	0	0
	Jig	156	0	0
	TOTAL	1,969,582	54,911	197,091
2002	Trawl	1,787,189	36,360	81,329
	Hook and Line	131,365	25	135
	Pot Gear	16,398	0	6
	Jig	0	0	0
	TOTAL	1,934,952	36,385	81,470

2001	Trawl	1,658,935	40,531	60,678
	Hook and Line	137,128	17	46
	Pot Gear	17,858	0	7
	Jig	0	0	0
	TOTAL	1,813,921	40,548	60,731
2000	Trawl	1,461,212	8,219	59,306
	Hook and Line	126,200	4	16
	Pot Gear	20,136	0	5
	Jig	0	0	0
	TOTAL	1,607,548	8,223	59,327
1999	Trawl	1,295,548	14,583	47,199
	Hook and Line	112,107	7	35
	Pot Gear	17,096	9	0
	Jig	0	0	0
	TOTAL	1,424,751	14,599	47,234

Numbers were generated using blend reports, CDQ catch reports, and queries on the catch accounting databases. Estimates prepared by NMFS, Sustainable Fisheries, Alaska Region.

In October 2005, the Council took final action on BSAI FMP Amendment 84, which changes PSC regulations in ways expected to help control BSAI salmon bycatch (NPFMC 2005d). Information from the pollock industry indicates that the rates of Chinook salmon bycatch within the CSSA was lower then outside the CSSA. Because the current PSC management for salmon appears not to be effective, the Council recommended Amendment 84a to the BSAI groundfish FMP to reduce salmon bycatch (NPFMC 2005a). Details of this amendment are in the EA/RIR/IRFA for the amendment. The purpose of the amendment is to allow the pollock industry to monitor and move away from areas of high salmon bycatch to lower the overall rate of salmon bycatch in the eastern Bering Sea. A cooperative agreement would be used to participate in a rolling voluntary hot spot (VRHS) program to move vessels from areas of high salmon bycatch to areas of lower salmon bycatch and still provide for pollock harvest. Vessels participating in the RVHS program would be exempt from the salmon savings area closures. The provisions of Amendment 84a are currently being implemented by an exempted fishing permit (EFP) for 2006 and an additional EFP is expected to be used in early 2007. Information gathered under the EFP(s) will allow the Council to determine the effectiveness and refine the program before permanent implementation through regulations and to determine if additional salmon bycatch measures in Amendment 84b would be necessary. The groundfish fisheries program in 2007 and 2008 will likely be implemented with this new salmon bycatch management program under Amendment 84a which is intended to reduce salmon bycatch in the pollock fishery.

It is not known if 2004, 2005, and 2006 were anomalously high years for the incidental catch of salmon in the BSAI or if similar rates of incidental take of salmon during the 2007 and 2008 groundfish fisheries can be expected. The higher incidental catch of salmon may also reflect an increased abundance of salmon in the BSAI. In western Alaskan rivers, salmon stocks of concern (Chinook and chum) met escapement goals in 2004, 2005, and 2006. In 2006 salmon runs exceeded escapement goals. The ADF&G does not provide stock projections for Chinook or chum salmon, which are likely to be taken in the BSAI groundfish fisheries (Plotnick and Eggers 2004). Information is not available to compare the take of Chinook and chum salmon to stock abundance.

In 2004, 2005 and 2006 the number of Chinook salmon taken in the BSAI groundfish fisheries exceeded the ESA-listed salmon Incidental Take Statement (ITS) amount of 55,000 Chinook salmon in the BSAI. The ESA listed salmon ITS is 55,000 total Chinook salmon of all origins; the amount is a proxy for a possible impact on ESA-listed salmon. The vast majority of Chinook salmon taken in the groundfish fisheries in Alaska is not likely to be ESA-listed salmon (NMFS 2006b).

The most recent information available for determining an abundance benchmark for ESA-listed salmon is the escapements listed in the 1999 biological opinion (NMFS 1999). Because of the changes in the environment and the age of the data, we question the usefulness of using these data for benchmark purposes today. The ESA incidental take statement for listed salmon is 55,000 Chinook salmon in the BSAI and 40,000 Chinook salmon in the GOA. (NMFS 1999) As described in Section 3.4, NMFS is currently consulting with the NMFS Northwest Region regarding the continued exceedence of the ITS and regarding the new information on the origin of salmon stocks taken in the groundfish fisheries. Based on coded-wire tag studies for the past 15 years on surrogate ESA-listed salmon stocks, only the Lower Columbia River and Upper Willamette River Chinook salmon stocks are likely to be adversely affected by the BSAI groundfish fisheries (NMFS 2006b). The NMFS Northwest region is scheduled to complete a biological opinion on the affects of the Alaska groundfish fisheries by the end of 2006.

Halibut

The International Pacific Halibut Commission (IPHC) is responsible for the conservation of the Pacific halibut resource. The IPHC uses a policy of harvest management based on constant exploitation rates. The constant exploitation rate is applied annually to the estimated exploitable biomass to determine a constant exploitation yield (CEY). The CEY is adjusted for removals that occur outside the commercial directed hook-and-line harvest (incidental catch in the groundfish fisheries, wastage in halibut fisheries, recreational harvest, and subsistence use) to determine the commercial directed hook-and-line quota.

Incidental catch of halibut in the groundfish fisheries results in a decline in the standing stock biomass, a lowering of the reproductive potential of the stock, and reduced short- and long-term yields to the directed hook-and-line fisheries.

Beginning in 1997 the IPHC divided the halibut bycatch mortality into two size groups, legal-sized halibut (greater than 32 inches in length) and sublegal-sized halibut (less than 32 inches in length); these groupings are based on length samples collected by observers each year. To compensate the halibut stock for these removals over the short term, the legal-sized halibut bycatch mortality in the groundfish fisheries is deducted on a pound for pound basis each year from the directed hook-and-line quota. The sublegal-sized halibut mortality results in further impacts on the long-term reproductive potential of the halibut stock. The impact of sublegal-sized halibut mortality is addressed within the target exploitation rate used by the IPHC to set harvest policy. In essence, the target harvest rate is reduced to account for the sublegal halibut mortality. Currently this amount is approximately 2 percent. Clark and Hare (1998) discuss this method in greater detail.

The most recent halibut stock assessment was conducted by the IPHC in December 2005. The halibut resource is considered to be healthy, with total catch near record levels. For 2006, the exploitable halibut biomass in Alaska was estimated to be 189,543 mt. In January 2006, the IPHC set commercial catch limits at 33,421 mt (round weight equivalents) in Alaskan waters for 2006.

Through July 11, 2006, catch of halibut in the directed commercial fisheries totaled 17,795 mt (round weight equivalents) in Alaskan waters. This is 53 percent of the 2006 commercial catch limit, which closes on November 15, 2006. Through July 1, 2006, BSAI halibut bycatch mortality in the groundfish fisheries totaled 2,821 mt of the annual 4,575 mt PSC limit, and GOA halibut bycatch mortality in the groundfish fisheries totaled 1,149 mt of the annual 2,300-mt PSC limit.

In September 2006 the IPHC will review halibut discard mortality rates in the groundfish fisheries for possible revision to the assumed discard mortality rates in the 2007 through 2009 groundfish fisheries. At its January 2007 annual meeting, the IPHC will set halibut catch limits for the 2007 commercial fishery. Similar levels of halibut incidental catch during the 2006 groundfish fisheries are expected for the 2007 and 2008 groundfish fisheries.

Pacific herring

Pacific herring are managed by the State of Alaska on a sustained yield principal. Pacific herring are surveyed each year and the GHLs are based on an exploitation rate of 20 percent of the projected spawning biomass. These GHLs may be adjusted in-season based on additional survey information to insure long-term sustainable yields. The ADF&G has established minimum spawning biomass thresholds for herring stocks that must be met before a commercial fishery may occur.

The most recent herring stock assessment for the EBS stock was conducted by ADF&G in December 2005. For 2006 and 2007, the herring biomass in the EBS is estimated to be 177,000 mt. Additional information on the life history of herring and management measures in the groundfish fisheries to conserve herring stocks can be found in Section 3.5 of the PSEIS (NMFS 2004b).

In the BSAI, the herring PSC limit for the groundfish trawl fisheries is set at one percent (1,770 mt) of the estimated herring biomass. Through July 1, 2006, an estimated 71 mt of the 1,770 mt herring PSC limit had been taken. In 2005, 693 mt of the 2,013 mt PSC limit of herring in the groundfish trawl fisheries in the BSAI was incidentally caught. In 2007 and 2008, the BSAI herring PSC limits will be based upon the results December 2006 EBS herring stock assessment conducted by ADF&G. Similar levels of herring incidental catch during the 2006 groundfish trawl fisheries are expected for the 2007 and 2008 groundfish trawl fisheries. There is no PSC limit for herring in the GOA as incidental catch is rare in the groundfish fisheries. The groundfish fisheries are not believed to have an impact on herring stocks in the GOA.

Crab

Alaska king, Tanner (*C. bairdi*), and snow (*C. opilio*) crab stocks in the BSAI and GOA are managed by the State of Alaska (with Federal oversight in the BSAI) on a sustained yield principal. The crab stocks are surveyed each year by NMFS in the BSAI and by ADF&G in the GOA. For the BSAI crab stocks, TACs are established for each stock from harvest strategies developed by ADF&G that apply an exploitation rate to legal sized male crab in each stock.

The most recent stock assessments for EBS crab stocks were conducted by ADF&G and NMFS in September 2005 (NPFMC 2005b). Additional information on the life history of crab and management measures in the groundfish fisheries to conserve crab stocks can be found in Section 3.5 of the PSEIS (NMFS 2004b) and in the EIS for BSAI crab fisheries (NMFS 2004a). Four stocks of crab; Saint Matthew Island blue king crab, Pribilof Islands blue king crab, Bering Sea Tanner crab (*C. bairdi*), and Bering Sea snow crab (*C. opilio*), are presently being managed under rebuilding plans. The Aleutian Islands golden king crab fishery will open August 15, 2006. ADF&G intends to announce the TACs for the additional crab fisheries in the BSAI October 1, 2006. Fisheries for these stocks will open on October 15, 2006.

In addition to area closures for trawl gear in both the BSAI and GOA, PSC limits have been established in the BSAI for the trawl groundfish fisheries in several areas. These PSC limits and areas are described in 50 CFR 679.21. Tables 7-2 through 7-9 detail the numbers of *C. bairdi*, snow, and red king crabs caught as bycatch in specific groundfish fisheries in 2005.

In 2006, in the *C. opilio* bycatch limitation zone, the 2006 trawl PSC limit was set at 5,761,674 animals. Through July 1, 2006, an estimated 804,624 crab had been taken. Of that, 741,079 (92 percent) were taken in the yellowfin sole fishery. In Zone 1 of the Bering Sea the 2006 PSC limit for *C. bairdi* Tanner crab was set at 980,000 animals. Through July 1, 2006, an estimated 203,434 crab had been taken. In Zone 2 of the Bering Sea, the 2006 PSC limit for *C. bairdi* Tanner crab was set at 2,970,000 animals. Through July1, 2006, an estimated 509,751 crab had been taken. In Zone 1 of the Bering Sea, the 2006 PSC limit for red king crab was set at 197,000 animals. Through July 1, 2006 an estimated 71,781 crab had been taken. Similar levels of crab incidental catch during the groundfish trawl fisheries are expected for the 2007 and 2008 groundfish fisheries. In October 2005 Council staff presented a discussion paper on possible methods to reduce crab bycatch in the GOA (NPFMC 2005c).

During the scoping process public comments were received expressing concerns about the impact of trawl gear on the *C. bairdi* Tanner Crab stock in the Central GOA (specifically near Kodiak). ADF&G conducts annual surveys of the crab stocks in the GOA (ADF&G 2006). The surveys are partial and concentrate on the historically most important areas of crab abundance; hence, the estimates of abundance are on the low side of total abundance in the area since the total crab habitat is only partially surveyed. In 2005 the estimate of *C. bairdi* Tanner crab in the Central Gulf was approximately 83 million animals. NMFS estimated the incidental catch in the groundfish fisheries to be approximately 184,000 animals or approximately 0.2 percent of the surveyed area. Half of the incidental catch was attributed to bottom trawl catch (mostly target Pacific cod and flatfish) and half of the incidental catch was attributed to pot gear targeting Pacific cod. In the Western GOA the *C. bairdi* population was estimated to be approximately 22.5 million animals in the area surveyed. NMFS estimated the incidental catch in the groundfish fisheries to be approximately 52,000 animals. Again, this amounts to about 0.2 percent of the surveyed population, almost all of which was taken by bottom trawl gear (W. Donaldson, pers. comm., July 2006). Incidental catches of this magnitude are not considered to have an impact on stocks of *C. bairdi* crab in the GOA. Through July 8, 2006, approximately 235,000 *C. bairdi* crab have been taken in the groundfish fisheries across the entire GOA.

Table 7-2 2005 Groundfish and PSC by trawl gear in the BSAI

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Atka mackerel	69,673	85	1,316	71	204	3,430
Pacific cod	81,225	1,360	144,608	4,986	3,929	729
Other flatfish	1,963	64	5,669	247	136	0
Flathead sole	23,384	239	267,660	427	43	443
Rock sole	41,381	765	393,268.9	48,125.5	324.2	0
Greenland turbot	81	3	116.7	0	0.0	0
Arrowtooth flounder	5,639	200	10,358	0	1,672	144
Yellowfin sole	120,106	572	746,081	60,494	382	485
Rockfish	8,298	17	0	600	0	0
Sablefish	31	0	447	0	0	0
Other species	10	1	0	0	0	0
Pollock (bottom)	32,047	15	9	0	2,170	7,804
Pollock (midwater)	1,430,409	87	598	0	63,768	690,027
Unidentified Target	22	0	0	0	0	0
Total	1,814,271	3,408	1,570,132	114,951	72,628	703,064

Target	Total Catch[1] (mt)	Numbers of Snow crab[2]	Herring (mt)
Rock sole, flathead sole, and other flatfish	66,729	723,294	17
Pacific cod	81,225	48,237	14
Pollock, Atka mackerel, and other species	1,532,140	2,048	616
Yellowfin sole	120,106	2,518,430	48
Rockfish	8,298	0	0
Greenland turbot, sablefish, and arrowtooth flounder	5,752	764	0
Total	1,814,271	3,292,773	695

Table 7-3 2005 Groundfish and PSC by hook-and-line gear in the BSAI

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	143,686	144	12,783	16,147	48	55
Greenland turbot	2,031	2	-	7	6	38
Sablefish	892	1	-	33	-	-
Rockfish	6	0	-	-	-	-
Other species	48	0	39	-	-	-
Arrowtooth flounder	8	0	-	-	-	-
Other groundfish	2	0	-	-	-	-
Total	146,673	147	12,821	16,187	55	93

Table 7-4 2005 Groundfish and PSC by pot gear in the BSAI

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	17,747	3	109,109	3,563	0	0
Sablefish	1,321	1	243	-	0	0
Total	19,076	3	109,352	3,563	0	0

Table 7-5 2005 Total Groundfish and PSC by all gear types in the BSAI

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
All	1,980,730	3,978	1,692,304	134,717	72,683	703,155

Table 7-6 2005 Groundfish and PSC by trawl gear in the GOA

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	12,336	652	1,255	-	37	141
Deep water flatfish	153	-	-	-	-	-
Rex sole	3,244	53	7,914	-	524	98
Flathead sole	3,059	33	32,474	-	16	-
Shallow water flatfish	8,157	556	6,086	88	61	1,804
Arrowtooth flounder	15,042	504	69,677	-	1,829	413
Rockfish	23,509	270	1,606	-	553	3,453
Other species	191	0	189	-	13,061	-
Sablefish	6	-	-	-	-	-
Pollock (bottom)	19,114	2	4	-	14,954	105
Pollock (midwater)	64,800	1	1	-	-	698
Total	149,610	2,070	119,205	88	31,034	6,712

Table 7-7 2005 Groundfish and PSC by hook-and-line gear in the GOA

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	6,156	211	1,384	-	-	-
Rockfish	166	-	-	-	-	-
Other species	260	0	-	-	-	-
Sablefish	14,627	297	380	103	-	179
Arrowtooth flounder	112	5	-	-	-	-
Deep water flatfish	-	-	-	-	-	-
Total[4]	21,321	513	1,764	103	-	179

Table 7-8 2005 Groundfish and PSC by pot gear in the GOA

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
Pacific cod	24,703	46	116,104	0	0	0
Total	24,705	46	116,104	0	0	0

Table 7-9 2005 Total groundfish and PSC by all gear types in the GOA

Target	Total Catch[1] (mt)	Halibut Mortality (mt)	Numbers[2] of *C. bairdi* Crab	Numbers of Red King Crab	Numbers of Chinook Salmon	Numbers of Other Salmon[3]
All	200,091	2,962	237,073	191	31,034	6,919

Source: NMFS catch accounting system through December 31, 2005
Notes:[1] Total catch includes all groundfish harvested, the targeted species as well as incidental catch of all other groundfish.
[2] Numbers are estimates of individual animals and include (in the case of crab) all animals, male and female, juvenile and adult, and should not be interpreted as an estimate of legal sized males that are targeted in directed crab fisheries.
[3] Other salmon numbers include pink, chum, coho, and sockeye, but the vast majority of other salmon are chum.
[4] The halibut mortality estimates include those from the pot and hook-and-line sablefish fisheries, which are exempt from halibut PSC limits.

7.2 Impacts of Alternative Harvest Strategies on Prohibited Species

For the purpose of this analysis, most impacts of the target fishery harvest strategies on prohibited species are assumed to be proportional to the anticipated annual groundfish harvest. It is also assumed that the current PSC limitations and area closures will remain in effect for 2007 and 2008. Bottom gear activity may be important for habitat impacts.

Mortality

- ***Status quo** Alternative 2:*
    - **Herring:** In the BSAI the herring PSC limit is set at 1 percent of the estimated herring biomass. Of that PSC, less than half is taken in the groundfish fisheries, mostly by pelagic trawl gear targeting pollock. Incidental catch of herring is very low in the groundfish fisheries in the GOA and there is no PSC limit in the GOA.
    - **BSAI crab:** Approximately 67 percent of the *C. opilio* crab PSC is taken annually, mostly in the yellowfin sole fishery. Approximately 25 percent of the *C. bairdi* PSC is taken in Zone 1 and 15 percent in Zone 2, mostly in the rock and yellowfin sole fisheries. Approximately 50 percent of the red king crab PSC is taken, mostly in the yellowfin sole fishery. These mortality levels represent such a small portion of the biomass they do not have an adverse impact on these stocks of prohibited species.
    - **GOA crab:** The incidental catch of crab (both *C. bairdi* Tanner and red king crab) is also very low compared to the biomass of the crab stocks. In the Central GOA, about 0.2 percent of the *C. bairdi* Tanner stock is taken in the groundfish fisheries annually. Approximately half is taken by bottom trawl gear and half by pot gear. In the Western GOA, about 0.2 percent of the *C. bairdi* Tanner crab stock is taken by trawl gear annually. Under the status quo harvest strategy, GOA Pacific cod TACs may decline significantly by 2008, potentially reducing the incidental catch of crab.

- **Halibut:** In the BSAI, nearly all of the halibut PSC is usually taken annually, mostly in the trawl fisheries using bottom gear. Halibut mortality in the groundfish fisheries is taken into account when the commercial halibut quotas are set to prevent adverse impacts on the halibut stocks. Each year the entire PSC level for halibut has been taken. In recent years, the trawl fisheries have been severely constrained by the 2,000 mt halibut PSC level in the GOA. As in the BSAI, the halibut mortality in the GOA groundfish fisheries is taken into account when the commercial halibut quotas are set to prevent adverse impacts on the halibut stocks.
- **Salmon:** Sockeye, pink, and coho salmon are rarely taken in the BSAI groundfish fisheries. The incidental catches of Chinook and chum salmon have increased dramatically in recent years. However escapement in excess of minimum needs has generally increased in recent years as well, allowing for subsistence use, recreational fishing, and commercial fishing activities. NMFS is currently consulting on ESA-listed Pacific salmon. While chum and Chinook salmon incidental catches have increased in recent years, this increased mortality does not appear to have adversely impacted these salmon stocks. Under the status quo harvest strategy, BSAI pollock TACs may decline significantly by 2008, potentially further reducing the incidental catch of prohibited species, especially salmon. Salmon stocks in the GOA are much larger and the incidental catch lower compared to the BSAI.

- *Alternative 1:* BSAI pollock TACs are equal to Alternative 2 levels under this alternative. In the GOA, pollock TACs are on the order of 13 to 18 percent higher. The greatest increases in the GOA TACs are for the flatfish targets. These increases in TAC would not necessarily lead to increases in groundfish harvest as the flatfish fishery harvests are constrained by the halibut PSC level. Annual harvest of groundfish would be expected to stay at recent average rates of approximately 180,000 mt due to constraints on the trawl fisheries imposed by the halibut PSC limit. This alternative would not be expected to lead to an increase or decrease in the incidental catch of prohibited species in the GOA. Incidental catch of prohibited species is still expected to be small in relation to GOA prohibited species biomass.

- *Alternative 3:* In the BSAI this alternative is associated with reduced pollock TACs compared to Alternatives 1 and 2, and much lower TACs for flatfish targets and Atka mackerel. Overall, compared to TACs totaling 2 million mt under Alternatives 1 and 2, Alternative 3 is approximately 27 percent lower in 2007 and 33 percent lower in 2008. As a result of lower pollock TACs, proportional decreases in the incidental catch and mortality of salmon and herring could be expected. As a result of the lower flatfish and Atka mackerel TACs, a proportional decrease in the incidental catch and mortality of halibut and crab could be expected. However, since status quo mortality is already quite small, a shift to this alternative may not have a big impact on stocks of prohibited species. In the GOA under Alternative 3, compared to the status quo, the total TACs are reduced by approximately 44 percent in 2007 and by 41 percent in 2008. The TACs are lower for all targets most notably pollock and Pacific cod. The sum of the TACs are lower than current average annual harvests, therefore the halibut PSC limits may not be reached and may result in reduced halibut mortality in both the trawl and hook-and-line fisheries. Lower pollock TACs may result in a reduction of the incidental catch and mortality of salmon. The TACs for other groundfish targets such as flatfish are similar to current harvest rates, therefore large reductions would not be expected in the incidental catch and mortality of crab. Due to the lower Pacific cod TACs, some modest reductions in incidental catch of crab by trawl and pot gear could be expected. Incidental catch of prohibited species is still expected to be small in relation to GOA prohibited species biomass.

- *Alternative 4:* In the BSAI, this alternative is associated with a very large reduction in pollock TACs compared to the status quo and therefore with reduced incidental catch and mortality of salmon and herring. Overall total TACs are approximately 30 percent lower in 2007 and 2008 than under the status quo. Incidental catch and mortality of halibut and crab would be expected to be lower than under the status quo but higher than under Alternative 3 due to the increase in yellowfin sole and arrowtooth flounder TACs compared to Alternative 3. Since status quo mortality is already quite small, a shift to this alternative may not have a big impact on stocks of prohibited species. In the GOA under Alternative 4, the total TACs are 36 percent lower in 2007 and 32 percent lower in 2008. Although the TACs are notably lower for Pacific cod and the rockfish targets, the TACs for the flatfish targets are much higher. These TACs are nearest to average annual overall harvests in the GOA. Reduced incidental catch and mortality of salmon would be expected as a result of the lower pollock TACs. Incidental catch and mortality of halibut and crab could be expected to decrease in the rockfish and Pacific cod fisheries but this would be offset by increased targeting of flatfish. Incidental catch of prohibited species is still expected to be small in relation to GOA prohibited species biomass.

- *Alternative 5:* No mortality would be imposed on stocks of prohibited species; however, given the small status quo fishing mortality rate, this may not have a big impact on stocks of prohibited species.

Genetic structure of the population

- ***Status quo*** *Alternative 2:* Limited information is available on the genetic structure of stocks of prohibited species. The North Pacific Observer Program is working with the NMFS Auke Bay lab to determine the origin of salmon taken in the BSAI groundfish fisheries using DNA analysis. This is a necessary step to determine the impact of incidental catch of salmon on the genetic structure of salmon stocks (NMFS 2006b). However, given the low fishing mortality rate believed to be associated with status quo levels of harvest, it is unlikely that groundfish fishing is having an impact on the genetic structure of salmon stocks. PSC limits and actual incidental catch amounts of other prohibited species (herring, halibut, and crab) are relatively low with respect to biomass and it is unlikely that groundfish fishing would have an impact on the genetic structure of these stocks of prohibited species under this alternative.

- *Alternative 1:* This alternative is associated with somewhat larger pollock harvests in the GOA (on the order of 13 to 18 percent above status quo levels), but not in the BSAI. As noted above, status quo fishing mortality rates are low. For this reason, current harvest rates are not believed to have an important impact on the genetic structure on stocks of salmon species. Even with an increase in pollock harvest of this magnitude, the mortality rate would remain low, and there may be little impact on genetic structure. As noted above in the discussion of mortality impacts, increased TACs for flatfish species would not be expected to increase harvest current levels in the GOA as these fisheries are constrained by halibut PSC limits. Currently incidental catch amounts of prohibited species are relatively low with respect to biomass and it is unlikely that groundfish fishing is having an impact on the genetic structure of these stocks of prohibited species.

- *Alternative 3:* As discussed above under mortality impacts in the BSAI and GOA, reduced groundfish TACs may reduce the incidental catch of prohibited species. However, status quo harvests are already small, and not believed to be having an impact on prohibited species stock genetics. This alternative would also have little impact.

- *Alternative 4:* As discussed above under mortality impacts in the BSAI and GOA, reduced groundfish may reduce the incidental catch of prohibited species. However, status quo harvests are already small, and not believed to be having an impact on prohibited species stock genetics. This alternative would also have little impact.

- *Alternative 5:* In the absence of fishing activity, there would be no fishing mortality related stock impacts. However, status quo fishing is not believed to have an impact on genetic structure, so a shift to this alternative may not have an impact on the stock genetic structure of prohibited species.

Reproductive success

- ***Status quo** Alternative 2:* The impacts of incidental catch on the reproductive success of prohibited species are largely related to the impacts of mortality related removals from the populations. Because the mortality of prohibited species in the groundfish fisheries is low compared the biomass of the prohibited species stocks, the impact of mortality on the reproductive success of prohibited species is small. Salmon spawn in freshwater and so are unaffected by groundfish fishing activities. Herring spawn in nearshore coastal waters and so are also unaffected by groundfish fishing activities. Halibut and crab spawn in offshore areas where fishing activities occur; however, impacts are small due to area closures to bottom trawl gear. Groundfish fishing is expected to have little impact on halibut or crab spawning, nursery, or settlement habitat. The EFH EIS describes the impact of groundfish fishing activity on prohibited species spawning habitat as having minimal, temporary, or no effect (NMFS 2005a, Chapter 4.3).

- *Alternative 1:* Pollock catches would be on the order of 13 to 18 percent higher under this alternative than the status quo in the GOA, and no higher in the BSAI. As noted, because of low fishing rates, and limited groundfish fishing in many inshore and offshore spawning areas, the status quo is not expected to have an important impact on prohibited species reproductive success. Increases in the TACs of flatfish targets are not expected to result in greater harvests due the halibut PSC limits. The modest increases in pollock harvest in the GOA may increase impacts somewhat, but the incremental impacts are expected to be modest, and to occur from a small base.

- *Alternative 3:* Groundfish TACs would be much lower under this alternative than the status quo. However, given the limited impact on reproductive success under the status quo, this alternative would be expected to have a limited impact itself, and to have an impact not dissimilar to that under the status quo. This, combined with low harvest rates, may mean that groundfish fishing under this alternative would have little impact on reproductive success of prohibited species and would have an impact similar to that under the status quo.

- *Alternative 4:* Groundfish TACs would be much lower than the status quo under this alternative in the BSAI. In the GOA, TACs would be much smaller for pollock, Pacific cod, and rockfish, and near average levels for other groundfish targets. However, given the limited impact on reproductive success under the status quo, this alternative would be expected to have a limited impact on the reproductive success of prohibited species and to have an impact similar to that under the status quo.

- *Alternative 5:* In the absence of fishing activity, there would be no fishing mortality related stock impacts. However, given the limited impact on reproductive success under the status quo, this alternative would be expected to have a limited impact on the reproductive success of prohibited species.

Prey availability

- ***Status quo*** *Alternative 2:* Prohibited species feed on zooplankton, euphausiids, other invertebrates, and juvenile groundfish that are unlikely to be directly affected by groundfish fishing activities. Predation on juvenile groundfish by prohibited species is not likely have an impact on groundfish populations as it represents only a small fraction of natural mortality. In turn prohibited species are preyed upon (especially in their early life stages) by groundfish. Under the status quo there are no anticipated impacts on prey availability. The relatively low sensitivity and high recovery rates of both infauna and epifauna prey species make them relatively resilient to groundfish fishing activities. No substantial changes would be anticipated in biomass or numbers in prohibited species' prey populations (NMFS 2005a, Chapter 4.3).

- *Alternative 1:* BSAI harvests would be similar to those under status quo; GOA harvests would be somewhat higher (on the order of 13 to 18 percent higher). The impact on prey availability to prohibited species is likely to be negligible.

- *Alternative 3:* BSAI and GOA total groundfish harvests would be lower than the status quo. The impact on prey availability to prohibited species is likely to be negligible.

- *Alternative 4:* Groundfish TACs would be much lower than the status quo under this alternative in the BSAI. In the GOA TACs would be much smaller for pollock, Pacific cod, and rockfish, and near average levels for other groundfish targets. The impact on prey availability to prohibited species is likely to be negligible.

- *Alternative 5:* Groundfish harvests would be set to zero. The impact on prey availability to prohibited species is likely to be negligible.

Habitat

- ***Status quo*** *Alternative 2:* Salmon and herring are primarily pelagic, using shallow waters, intertidal zones, and rivers for spawning habitat. In general, the EFH EIS finds that habitat impacts from fishing activity have minimal, temporary, or no effect on forage fish like herring (NMFS 2005a, Chapter 4.3). Halibut forage primarily on the seafloor both offshore during the winter and nearer to shore in shallower waters in the summer. Crab inhabit the seafloor; a structurally diverse seafloor provides important shelter for juvenile crab. Benthic habitat is at greater risk of impacts from groundfish fishing activities than pelagic habitat. Fishing activities may impact benthic biodiversity and habitat complexity of crab and halibut. The literature on these effects is reviewed in Chapter 3.4 of the EFH EIS (NMFS 2005a). In general, the EFH EIS finds that under the status quo, groundfish fishing activities have minimal, temporary, or no effect on halibut and crab stocks.

- *Alternative 1:* BSAI harvests would be similar to those under the status quo; GOA harvests would be somewhat higher. There would be little impact on the habitat of most prohibited species.

- *Alternative 3:* BSAI and GOA harvests are lower under Alternative 3 than under the status quo. There would be little change in the impact on the habitat for prohibited species.

- *Alternative 4:* BSAI and GOA harvests are lower under Alternative 4 than under the status quo. There would be little change in the impact on the habitat for most prohibited species. The reductions in the rockfish TACs under this alternative could reduce impacts on structurally complex habitat important to juvenile crab.

- *Alternative 5:* There would be no groundfish harvests under this alternative. There would be little change in the impact on the habitat for most prohibited species.

Table 7-10 Summary of impacts on prohibited species

		Alternative 1	Alternative 2	Alternatives 3, 4, and 5
Mortality		Somewhat greater fishing activity than under status quo. However, status quo incidental catch rates are so low, that this harvest increase should leave fishing mortality rate low.	Status quo takes only small amounts of prohibited species and incidental catch of prohibited species is believed to be small compared to biomass.	Smaller impact than status quo. Given limited status quo impact this may not mean much change for prohibited species. Alts 3 and 4 would reduce the mortality of Chinook and chum salmon in the BSAI. Alt 5 would eliminate mortality caused by fishing activities. Alts 3, 4, and 5 would have little impact on prohibited species biomass.
Spatial and temporal impacts	**Genetic structure of population**	Somewhat greater fishing activity than under status quo. However, status quo incidental catch rates are so low that genetic impacts under this alternative are believed to be small.	There is little information on genetic composition of stocks of prohibited species. Because incidental catch rates are low, genetic impacts are believed to be small.	Smaller impact than status quo. Given limited status quo impact this may not mean much change for prohibited species.
	Reproductive success	Somewhat greater fishing activity than under status quo. However, fishing is not expected to interfere with spawning, and status quo incidental catch rates are so low, reproductive success impacts under this alternative are believed to be small.	Most prohibited species reproduce in protected areas, or are broadcast spawners. Incidental catch rates are low. Fishing impact on reproductive success is believed to be small.	Smaller impact than status quo. Given limited status quo impact this may not mean much change for prohibited species.
Prey		Somewhat greater fishing activity than under status quo. However, prohibited species consume species unlikely to be affected by fishing, or feed where there is relatively little fishing activity. Impacts are expected to be small	Prohibited species consume species unlikely to be affected by fishing, or feed where there is relatively little fishing activity. Impacts are expected to be small.	Smaller impact than status quo. Given limited status quo impact this may not mean much change for prohibited species.
Habitat		Somewhat greater fishing activity than under status quo. Salmon and herring fish are primarily pelagic, using shallow inshore or river waters for spawning. In general, impacts are expected to be small.	Salmon and herring are primarily pelagic, using shallow inshore or river waters for spawning. In general, impacts on halibut and crab are expected to be small.	Smaller impact than status quo. Given limited status quo impact this may not mean much change for prohibited species.

7.3 Reasonably Foreseeable Future Actions that may Affect the Impact of Groundfish Fishing on Prohibited Species

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the harvest strategy alternatives on prohibited species. These actions are described in Section 3.2 of this document.

Ecosystems approaches to management

Ecosystem research, and increasing attention to ecosystem issues, should lead to increased attention to the impact of fishing activity on non-target resource components, including prohibited species. This is likely to result in reduced adverse impacts. The North Pacific Groundfish Observer Program and Auke Bay Lab collection and analysis of salmon tissue samples will help identify the natal streams of origin of bycaught salmon, and help clarify the dimensions of the environmental impact.

BSAI Amendments 84a and 84b are intended to reduce salmon incidental take in the pollock trawl fisheries in the BSAI. As discussed above, Amendment 84a was approved by the Council in October 2005 but concerns regarding management of the program have prevented implementation of the FMP amendments and regulation changes at this time. NMFS is implementing provisions for pollock cooperative's rolling hot spot authority measures to reduce salmon bycatch in August 2006 through an exempted fishing permit (EFP). Information from the EFP will determine if the program will be effective in minimizing salmon incidental take. An additional EFP to continue implementation of this program in 2007 may be necessary. If effective, the program may be implemented through Amendment 84a in time for the Fall 2007 "B" pollock fishery. The development of Amendment 84b will be dependent on the findings from implementation of the EFPs.

Rationalization

The rationalization programs currently under consideration in both the BSAI and GOA will consider methods to reduce the incidental catch of prohibited species in the groundfish fisheries affected. Fisheries rationalization may allow for better incidental catch controls and monitoring in the groundfish fisheries. To the extent rationalization improves fishing practices and reduces incidental catch, it would reduce the adverse effects on prohibited species. Prohibited species caps may be established for salmon and crab under GOA Rationalization. In all areas, rationalization programs may include individual or cooperative incidental catch accounts which could encourage fishermen to reduce their incidental catch of prohibited species.

Traditional management tools

Annual specifications will authorize annual groundfish fishing activity and associated annual incidental catches of PSC species. The improvement of the Catch Accounting System has made it possible for NMFS to maintain more timely and accurate information regarding the incidental catch of prohibited species. This information can be used by NMFS and the industry to reduce incidental catch of prohibited species by tracking when and where it is occurring and react quickly to reduce the potential for additional incidental catch. Ongoing and new research on the modification of fishing gear (both pot and trawl gear) to reduce the incidental catch of prohibited species could prove economically efficient for the fleet to adopt. The testing of modified or novel fishing gear is often carried out under the terms of an exempted fishery permits. Testing of salmon and halibut excluder devices are currently being conducted under EFPs issued by NMFS (NMFS 2005b, 2006a).

Private sector actions

Fishing activity will continue in future years as constrained by fishing regulations and the ABCs and TACs set by the Council in each year. This fishing activity is expected to result in annual incidental catches of the prohibited species, subject to the FMP and regulatory measures that constrain groundfish fishery PSC. The Marine Stewardship Council's certification of the pollock fishery may add to pollock industry incentives to minimize Chinook and chum salmon bycatch. Additionally, the current development and future use of salmon and halibut excluder devices for trawl vessels may result in decreases of Chinook and chum salmon, and halibut incidental catch. The initial reports of the prototype excluder resulted in 43 percent escapement of Chinook and 9 percent for chum salmon. Further improvements to the excluder device in 2006 may increase the escapement rates and benefit species, especially Chinook salmon. A National Resource Council Committee has prepared a review of the Arctic-Yukon-Kuskokwim (AYK) Research and Restoration Plan for Salmon (AYK SSI 2006). This research and restoration plan was prepared by a collaboration of eight partner institutions, the AYK Sustainable Salmon Initiative (SSI). The purpose of the AYK SSI is to develop and implement a comprehensive research plan to understand the causes of the declines and recoveries of AYK salmon.

7.4 References

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7.5 Preparers and Persons Consulted

Preparers

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Chapter 8 Marine Mammals

8.1 Marine Mammals in the Action Area

This resource component includes the marine mammal stocks described in Table 8-1. Some marine mammal species are resident throughout the year, while others migrate into or out of the management areas. The BSAI and GOA support one of the richest assemblages of marine mammals in the world. Twenty-eight species are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises). Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry et al. 1982). In 2004, three blue whales were identified in the GOA for the first time in 30 years (NMFS News release NOAA-04-R160, July 27, 2004, available at http://www.nmfs.noaa.gov).

The PSEIS (NMFS 2004a) provides descriptions of the range, habitat, diet, abundance, and population status for these marine mammals. The most recent marine mammal stock assessment reports (SARs) for nearly all species in the table were completed in 2005 based on 2002 though 2004 data (Angliss and Outlaw 2005). Northern elephant seals, and marine mammals under USFWS jurisdiction, were assessed in 2002 (Angliss and Outlaw 2005). This information is incorporated by reference.

Table 8-1 Marine mammal stocks occurring in Alaskan waters

NMFS Managed Species		
Pinnipedia	***Species***	***Stocks***
	Steller sea lion*	Western U.S (west of 144° W long.) and Eastern U.S. (east of 144° W long.)
	Northern fur seal**	Eastern Pacific
	Harbor seal	Southeast Alaska, Gulf of Alaska, Bering Sea
	Spotted seal	Alaska
	Bearded seal	Alaska
	Ringed seal	Alaska
	Ribbon seal	Alaska
	Northern elephant seal	California
Cetacea	***Species***	***Stocks***
	Beluga Whale	Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, Bristol Bay, Cook Inlet**
	Killer whale	Eastern North Pacific Northern Resident, Eastern North Pacific Alaska Resident, Eastern North Pacific GOA, Aleutian Islands, and Bering Sea transient, AT1 transient**, West Coast Transient
	Pacific White-sided dolphin	North Pacific
	Harbor porpoise	Southeast Alaska, Gulf of Alaska, and Bering Sea
	Dall's porpoise	Alaska
	Sperm whale*	North Pacific
	Baird's beaked whale	Alaska
	Cuvier's beaked whale	Alaska
	Stejneger's beaked whale	Alaska
	Gray whale	Eastern North Pacific
	Humpback whale*	Western North Pacific, Central North Pacific
	Fin whale*	Northeast Pacific
	Minke whale	Alaska
	North Pacific right whale*	North Pacific
	Bowhead whale*	Western Arctic
	Blue whale*	North Pacific
	Sei whale*	North Pacific
USFWS Managed Species		
	Species	***Stock***
Ursidae	Polar bear	Chukchi/Bering Seas, Southern Beaufort Sea
Mustelidae	Northern sea otter*	Southeast Alaska, Southcentral Alaska, Southwest Alaska
Pinnipedia	Pacific walrus	Alaska
Source: Angliss and Outlaw 2005. Contents and Appendix 8. *ESA-listed species. **Listed as depleted under the MMPA.		

8.2 ESA Consultations for Marine Mammals

NMFS is both the action and the consulting agency for ESA-listed species under NMFS' jurisdiction. In 2000, NMFS determined that the groundfish fisheries were likely to jeopardize the western distinct population segment (DPS) of Steller sea lions and adversely modify its critical habitat (NMFS 2000; NMFS 2001). As a result of that determination, NMFS enacted Steller sea lion protection measures (68 FR 204, January 2, 2003) to avoid the likelihood of jeopardizing the population or adversely modifying Steller sea lion designated critical habitat. Groundfish fisheries must comply with these measures. No other ESA-listed marine mammal has been the subject of a jeopardy determination by NMFS.

The NMFS Alaska Region Protected Resources Division (PRD) determined that separate consultation for harvest specifications based on the Council's recommendation is not necessary for NMFS managed listed species due to the formal consultations completed on the groundfish fisheries at the FMP and regulatory levels (Payne 2002). The 2000 FMP BiOp and the 2001 Steller sea lion protection measures BiOp describe the groundfish fisheries conservation measures and reasonable and prudent measures under the Incidental Take Statement. If Alternative 2 is chosen, a new consultation will not be necessary because the action will be the same as the harvest strategy that was consulted on previously, and no conditions for reinitiation of consultation will have been met.

A new program-level consultation on the groundfish fisheries (i.e., FMP-level) was reinitiated in 2006 for all NMFS managed marine mammals (NMFS 2006b). On April 19, 2006, NMFS Alaska Region Sustainable Fisheries Division (SFD) prepared a BA and requested reinitiation of consultation on ESA-listed marine mammals that were likely to be adversely affected by the Alaska groundfish fisheries (NMFS 2006b; Salveson 2006a). The Alaska Region PRD concurred with reinitiating the formal consultation on the eastern and western DPSs of Steller sea lions and their critical habitat, sperm whales, and humpback whales. The formal consultation is expected to be completed in 2007. During the consultation, the Council's Steller Sea Lion Mitigation Committee will develop proposed changes to the Steller sea lion protection measures. The Council's recommended changes will be included in the final version of the BiOp, and implementing regulations for the proposed changes are expected in 2008. Any changes to the groundfish fisheries Steller sea lion protection measures will be analyzed in a NEPA analysis before implementation.

The first recovery plan for Steller sea lions was completed in December 1992 and covered the entire range of Steller sea lions. However, the recovery plan became obsolete after the population was split into the western and eastern DPSs in 1997. Nearly all of the recovery actions contained in the first plan had also been completed by 2005. A draft recovery plan for Steller sea lions was released for public review on May 24, 2006 (71 FR 29919), with comments invited through September 1, 2006. The draft plan describes the actions necessary for the conservation and recovery of Steller sea lions. The draft plan contains: (1) a comprehensive review of Steller sea lion ecology, (2) a review of previous conservation actions, (3) a threats assessment, (4) biological and recovery criteria for downlisting and delisting, (4) actions necessary for the recovery of the species (78 discrete actions for the western DPS), and (5) estimates of time and cost to recovery. The threats assessment concludes that the following threats are relatively minor: (1) Alaska Native subsistence harvest, (2) illegal shooting, (3) entanglement in marine debris, (4) disease, and (5) disturbance from vessel traffic and scientific research. Although much has been learned about Steller sea lions and the North Pacific ecosystem, considerable uncertainty remains about the magnitude and likelihood of the following potential threats (relative impacts in parenthesis): competition with fisheries (potentially high), environmental variability (potentially high), killer whale predation (potentially high), incidental take by fisheries (medium), and toxic substances (medium).

NMFS has designated critical habitat for the northern right whale in Alaskan waters (71 FR 38277, July 6, 2006). Based on the new critical habitat designation and as required by 50 CFR 402.16, NMFS reinitiated consultation on the groundfish fisheries on August 7, 2006 (Salveson 2006b). The proposed critical habitat is considered in the BA for the FMP-level formal consultation for the groundfish fisheries (NMFS 2006b) and this is used to support the reinitiation of consultation for the critical habitat designation. NMFS also is considering listing the North Pacific right whale as a separate species from the Atlantic right whale (70 FR 1830, January 11, 2005). Designation of a species is a trigger for reinitiation of formal consultation under the ESA regulations (50 CFR 402.16). Consultation on the new species listing will be reinitiated once the species designation is finalized.

An informal consultation with the USFWS on the effects of the groundfish fisheries on the southwest Alaska DPS of northern sea otters was completed in 2006 (Mecum 2006). The southwest Alaska DPS of northern sea otter is listed as threatened under the ESA (70 FR 46365, August 9, 2005). Overall, this DPS has declined by more than half since the 1980s and by 90 percent in some locations. The USFWS is developing a recovery plan for the southwest Alaska DPS of northern sea otters under the ESA.

The informal consultation concluded that the groundfish fisheries were not likely to adversely affect northern sea otters (Mecum 2006). The USFWS has determined that, based on available data, sea otter abundance is not likely to be significantly affected by commercial fishery interaction at present (Angliss and Outlaw 2005), and commercial fishing is not likely a factor in the population decline (70 FR 46365, August 9, 2005). Northern sea otters are not likely to interact with groundfish fisheries in the Alaska EEZ because the areas of fishing and the types of prey preferred by otters do not overlap with the groundfish fisheries. Otters feed primarily in the rocky near shore areas on invertebrates, while groundfish fisheries are conducted further offshore on groundfish species (Funk 2003). Otters may also feed on clams in Federal waters in the soft sediment substrate of Bristol Bay and Kodiak areas (70 FR 46365, August 9, 2005). Portions of the EEZ used by sea otters in Bristol Bay are closed to trawling (50 CFR 679.22(a)(9)). This trawl closure reduces potential interaction between trawl vessels and sea otters and ensures the clam habitat used by sea otters is not disturbed. NMFS observers monitored incidental take in the 1990–2000 groundfish trawl, longline, and pot fisheries. No mortality or serious injuries to sea otters were observed in the EEZ. One sea otter mortality in the trawl fishery of the BSAI was reported in 1997, but no other sea otter mortality in the groundfish fisheries in the EEZ off Alaska has been reported (Funk 2003).

8.3 Impacts of alternatives

Interactions between marine mammals and groundfish harvest may occur due to overlap in the size and species of groundfish that are both harvested in the fisheries, and important marine mammal prey, and due to temporal and spatial overlap in marine mammal occurrence and commercial fishing activities.

Impacts of the alternatives are analyzed by addressing three questions:

(1) Do the proposed harvest levels result in increases in direct interactions with marine mammals (incidental take and entanglement in marine debris)?
(2) Do the proposed harvest levels remove prey species at levels or in areas that could compromise foraging success of marine mammals (harvest of prey species)?
(3) Do the proposed harvest levels modify marine mammal behavior (disturbance)?

This analysis determines (a) whether takings, prey competition, or disturbance occur under each alternative, and (b) if they do occur, the relative level of impact.

Table 8-2 provides a summary of the impacts of the alternative on marine mammals. The impacts are discussed in detail in the following sections.

Table 8-2 Summary of impacts of alternatives on marine mammals

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Incidental take	Potential take below PBR* for all marine mammals. Cumulative take from all sources of human-caused mortality below PBR.	Potential take below PBR for all marine mammals. Cumulative take from all sources of human-caused mortality below PBR.	Potential take below PBR for all marine mammals. Least potential for takes for 63% of marine mammals. Cumulative take from all sources of human-caused mortality below PBR.	Potential take below PBR for all marine mammals. Least potential for takes for 59% of marine mammals. Cumulative take from all sources of human-caused mortality below PBR.	No take.
Harvest of prey species	Competition for key prey species not likely to constrain foraging success of marine mammal species or cause population declines, except for Steller sea lions and fur seals where prey competition may be a concern.	Competition for key prey species not likely to constrain foraging success of marine mammal species or cause population declines, except for Steller sea lions and fur seals where prey competition may be a concern.	Competition for key prey species not likely to constrain foraging success of marine mammal species or cause population declines, except for Steller sea lions and fur seals where prey competition may be a concern.	Competition for key prey species not likely to constrain foraging success of marine mammal species or cause population declines, except for Steller sea lions and fur seals where prey competition may be a concern.	No harvest of prey species.
Disturbance	Disturbance of mammals not likely to cause population declines.	Disturbance of mammals not likely to cause population declines.	Disturbance of mammals not likely to cause population declines.	Disturbance of mammals not likely to cause population declines.	No disturbance.
* PBR, potential biological removal, is defined and discussed below in section 8.3.1.					

8.3.1 Incidental Take/Entanglement in Fishing Operations and Marine Debris

Since 1990, the BSAI and GOA groundfish fisheries have incidentally taken the following marine mammal species: Steller sea lions, harbor seals, northern elephant seals, northern fur seals, spotted seals, bearded seals, ribbon seals, ringed seals, Dall's porpoise, harbor porpoise (BSAI), Pacific white sided dolphins, killer whales, humpback whales, walrus, minke whale, fin whale, and sperm whale (Angliss and Outlaw 2005, Appendix 5). Marine mammals that are not included on this list are assumed to be unlikely to be incidentally taken by any of the five alternatives due to the absence of incidental take and entanglement records. No records of Alaska groundfish fisheries takes of North Pacific right whales or blue whales exist.

The SARs document the quantifiable effects on marine mammals. The National Marine Mammal Laboratory (NMML) completes SARs for marine mammals occurring in Alaskan waters (Angliss and Outlaw 2005). The SARs are reviewed annually for stocks designated as strategic under the MMPA, annually for stocks where there is significant new information available, and at least once every three years for all other stocks as required by the MMPA. The reports are available at the NMFS Alaska Region website at: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/individual_sars.html.

The SARs provide population estimates, population trends, and estimates of the potential biological removal levels (PBR) for each stock. The SARs also identify potential causes of mortality and whether the stock is considered a strategic stock under the MMPA.

To understand the level of potential impact of incidental take by the groundfish fisheries, the projected take of marine mammals is compared to the PBR and the Zero Mortality Rate Goal (ZMRG). The PBR is the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, as defined by the MMPA (16 U.S.C. 1362 (20)). When available, the PBR is used as the measure of potential impact from fisheries mortality. The PBR is identified in the marine mammal stock assessments (Angliss and Outlaw 2005) as the level at which animals may be removed from the stocks while the stocks achieve sustainable populations. Incidental take is predicted to adversely affect marine mammal populations when the proposed harvest levels result in a take that may exceed the PBR.

Table 8-3 compares the estimated incidental take of marine mammals to the PBR established in the 2005 Marine Mammal SAR (Angliss and Outlaw 2005). Annual levels of incidental mortality for the groundfish fisheries are based on observed takes, extrapolated to all (observed and unobserved) groundfish harvest. Therefore, qualitative estimates of direction of change of incidental take and entanglement based on estimated TACs are appropriate.

Table 8-3 Estimated mean annual mortality of marine mammals from observed BSAI and GOA groundfish fisheries compared to the total mean annual human-caused mortality and potential biological removal for each stock.

Mean annual mortality, expressed in number of animals, includes both incidental takes and entanglements, as data are available, and averaged over several years of data. Years chosen vary by species. Groundfish fisheries mortality calculated based on Angliss and Outlaw (2005).

Marine Mammal	Mean annual mortality, from BSAI and GOA groundfish fisheries	Total mean annual human-caused mortality *	PBR
**Steller sea lions (western)	10.8	217.9	231
**Steller sea lions (eastern)	2.2	9.1	1,967
Northern fur seal	0.48	885	14,546
***Northern elephant seal	0	86	2,513
Harbor seal (SE AK)	4.0	1,785	2,114
Harbor seal (BSAI)	4.0	192	379
Harbor seal (GOA)	0.6	827	868
Spotted seal	0	5,265	Undetermined
Bearded seal	1.6	6,790	Undetermined
Ringed seal	0.7	9,568	Undetermined
Ribbon seal	0.8	194	Undetermined
Killer whale Eastern North Pacific AK resident	2.3	2.3	11.2
Killer whale Eastern North Pacific Northern resident	0	0	2.16
Killer whale GOA, BSAI transient	2.4	2.3	3.1
Killer whale AT1 transient	0	0	0
Killer whale West Coast transient	0	0	3.1
Pacific white-sided dolphin	0.8	4	Undetermined
Harbor porpoise South East AK	0	3	90
Harbor porpoise GOA	0	40.3	255
Harbor porpoise BSAI	1.1	4	393
Dall's porpoise	5.9	38	1,537
Beaked whale	0	0	Undetermined
**Humpback whale Western North Pacific	0.5	0.7	1.3
**Humpback whale Central North Pacific	0.5	4.1	12.9
**North Pacific right whale	0	0	0
Minke whale Alaska	0.3	0.3	Undetermined
**Sperm whale North Pacific	0.5	0.5	Undetermined
**Fin whale Northeast Pacific	0.6	0.8	11.4
** Bowhead whale Western Arctic	0	41	95
Blue whale Eastern N. Pacific	0	0	2.8
Pacific walrus	1.2	5,794	Undetermined
Polar bear Chukchi/Bering Sea	0	undetermined	Undetermined
Sea otter Southcentral Alaska	0	297	1,396
**Sea otter Southwest Alaska	0	97	830
Sea otter Southeast Alaska	0	301	927

* Does not include research mortality. Other human-caused mortality is predominantly subsistence harvests for seals, sea lions, otters, bowhead whales, and walrus.
** ESA-listed stock.
*** From 2002 SAR, http://www.nmfs.noaa.gov/pr/pdfs/sars/PO02northernelephantseal_CAbreeding.pdf.

NMFS' management goal, as required by the MMPA, is total marine mammal mortality below the ZMRG for all commercial fisheries. NMFS has defined ZMRG as 10 percent of the PBR (69 FR 43338). Where the total marine mammal mortality and serious injury for all fisheries is above 10 percent of PBR for a given marine mammal stock, an individual fishery is considered to have met ZMRG for that stocks, if that fishery resulted in mortality or serious injury that is less than 1 percent of the PBR of that marine mammal stock. Marine mammal mortality and serious injury below the ZMRG is considered to be at an insignificant level approaching a zero rate.

NMFS annually categorizes all U.S. commercial fisheries (State and Federal) under the MMPA List of Fisheries according to the levels of marine mammal mortality and serious injury. Each fishery is classified through a two-tiered analysis which assesses the potential cumulative impact of all fisheries, as well as individual fisheries impacts, on a marine mammal stock by comparing mortality and serious injury levels to the PBR of each marine mammal stock. The List of Fisheries for 2005 was published in the *Federal Register* on January 4, 2006 (71 FR 247). Category III fisheries interact with marine mammal stocks with annual mortality and serious injury less than or equal to 1 percent of the marine mammal's PBR level and total fishery-related mortality less than 10 percent of PBR. Any fishery in Category III is considered to have achieved the target levels of mortality and serious injury under the ZMRG (NMFS 2004b). Category II fisheries have a level of mortality and serious injury that exceeds 1 percent but is less than 50 percent of the stock's PBR level, if total fishery related mortality is greater than or equal to 10 percent of the PBR. Category I fisheries have frequent mortality and serious injury of marine mammal resulting in annual mortality greater that or equal to 50 percent of PRB. No Alaska groundfish fisheries are included in Category I.

Table 8-4 provides the Federal groundfish fisheries in Category II and III and the marine mammal stocks that have been incidentally taken based on SARs from 1996, 2001 through 2005. Details on the numbers of animals taken are in the 2005 SAR (Angliss and Outlaw 2005). NMFS has proposed to move the BSAI Greenland turbot fishery from Category II to Category III (71 FR 20941; April 24, 2006) due to the average rate of mortality for killer whales in the Greenland Turbot fishery during 2000-2004 decreasing to 0.0 animals from 0.6 animals during 1999-2003.

Table 8-4 Category II and III Alaska groundfish fisheries with documented marine mammal takes from the proposed List of Fisheries for 2006 (71 FR 20941; April 24, 2006)

Fishery	Marine Mammal Stocks Taken
Category II	
BSAI flatfish trawl	*Killer whale, AK resident Bearded seal, AK Harbor porpoise, Bering Sea Harbor seal, Bering Sea Northern fur seal, Eastern North Pacific Spotted seal, AK Walrus, AK *Steller sea lions, Western U. S
BSAI pollock trawl	Dall's porpoise, AK Harbor seal, Bering Sea *Killer whale, Eastern North Pacific, GOA, Aleutian Islands, and Bering Sea transient *Steller sea lions, Western U. S *Humpback whale, Central and Western N. Pacific Minke whale, AK Ribbon seal, AK Spotted seal, AK
BSAI Pacific cod longline	*Killer whale AK resident and Eastern North Pacific, GOA, Aleutian Islands, and Bering Sea transient Ribbon seal, AK Steller sea lion, Western U. S.
Bering Sea sablefish pot	*Humpback whale, Central and Western N. Pacific
Category III	
GOA sablefish longline	Sperm whale, North Pacific Steller sea lion, Eastern U. S.
GOA Pacific cod trawl	Steller sea lions, Western U. S.
GOA pollock trawl	Fin whale, Northeast Pacific Northern elephant seal, North Pacific Steller sea lion, Western U. S.
GOA Pacific cod pot	Harbor seals, GOA
BSAI Pacific cod trawl	Harbor seals, Bering Sea Steller sea lions, Western U. S.
BSAI Atka mackerel trawl	Steller sea lions, Western U. S
BSAI Greenland turbot longline	Killer whale AK resident and Eastern North Pacific, GOA, Aleutian Islands, and Bering Sea transient
*Serious injuries and mortalities of this stock are greater than 1 percent, but less than 50 percent of the stock's PBR, therefore bycatch of this stock determines this fishery's classification.	

Summary Comparison of Incidental Takes under Alternatives

The following sections review the predicted incidental take of marine mammals in the groundfish fisheries and the effects of the alternatives on incidental take. Only those species shown to have been taken in the groundfish fisheries (Tables 8-3 and 8-4) are discussed here. Qualitative estimates of the direction of change of incidental take and entanglement are based on estimated TACs for key groundfish species. This is appropriate because annual levels of incidental mortality for the groundfish fisheries are extrapolated from observed incidental takes that result in mortality compared to observed groundfish catch, and extrapolated to unobserved catch. Additionally, the harvest strategies only impact the TAC levels and all existing management measures remain the same under all alternatives.

NMFS modified groundfish fisheries management to comply with ESA considerations for Steller sea lions (NMFS 2001). Under all alternatives, existing area closures protect Steller sea lions and other marine mammals, spatially disperse the groundfish fisheries, and thereby reduce the potential for incidental take of marine mammals by reducing fisheries-mammal interactions.

No incidental take in the BSAI and GOA would occur under Alternative 5 because fishing would not be authorized. Some debris may be present that could pose an entanglement threat. This threat may diminish over time if the debris decomposes. Because Alternative 5 poses no incidental take threat and little entanglement threat, this alternative will not be further discussed in the remainder of this section.

Table 8-5 compares the potential for incidental takes under Alternatives 1, 2, 3, and 4. Takes under Alternative 2, the status quo harvest strategy, are expected to be similar to past levels of take shown in Table 8-3. Since the PBR represents the number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, incidental takes below the ZMRG (10 percent of the PBR) would have biologically insignificant effects on marine mammal populations. Under Alternative 2, the marine mammal mortality in all of the groundfish fisheries is below the ZMRG for all but three populations of marine mammals (western stock of Steller sea lions, resident and transient killer whales and Western North Pacific humpback whales)

Table 8-5 Comparison of the potential for incidental takes under the alternatives

Marine Mammal	Alternative 2 (status quo)	Alternative 1	Alternative 3	Alternative 4
Steller sea lions (western)	Potential for takes of 4% of PBR	Similar to Alternative 2	Least potential for takes among alternatives	Less potential from Alternative 2
Steller sea lions (eastern)	0.1% of PBR	Similar	Least potential	Less potential
Northern fur seal	0.002% of PBR	Similar	Least potential	Less potential
Northern elephant seal	0	similar	similar	Least potential
Harbor seal (SE AK)	0.2% of PBR	similar	Least potential	Less potential
Harbor seal (BSAI)	1.05% of PBR	similar	Least potential in 2008	Least potential in 2007
Harbor seals (GOA)	0.07% of PBR	Increased potential for takes from Alternative 2	Least potential	Less potential
Spotted seal	0	Similar	Less potential	Less potential
Bearded seal	>2 animals	Similar	Less potential	Less potential
Ringed seal	>1 animal	Similar	Less potential	Less potential
Ribbon seal	>1 animal	Similar	Less potential	Less potential
Killer whale Eastern North Pacific AK resident	21% of PBR	Similar	Less potential	Least potential
Killer whale GOA, BSAI transient	75% of PBR	Similar	Less potential in BSAI	Least potential in BSAI
Pacific white-sided dolphin	>1 animal	Similar	Less potential	Less potential
Harbor porpoise BSAI	0.3% of PBR	Similar	Least potential	Less potential
Dall's porpoise	0.4% of PBR	Similar	Less potential	Least potential
Humpback whale western North Pacific	38% of PBR	Similar	Less potential	Least potential
Humpback whale central North Pacific	3.8% of PBR	Similar	Less potential	Least potential
Minke whale, Alaska	>1 animal	Similar	Less potential	Least potential
Sperm whales, North Pacific	>1 animal	Similar	Least potential	Similar
Fin whale, Northeast Pacific	5.2% of PBR	Similar	Less potential	Least potential
Pacific walrus	>2 animals	Similar	Least potential	Similar (07), less potential (08)

Steller sea lion

The groundfish fisheries alone do not cause enough mortality to exceed the PBR under any alternative. The total groundfish fisheries take of Steller sea lions is 4 percent of the PBR for the western DPS. Most Steller sea lion incidental take from the western DPS occurs in the BSAI flatfish trawl fishery (3.35 animals per year) followed by the BSAI pollock trawl fishery (2.72 animals per year; Angliss and Outlaw 2005). These two fisheries each cause serious injuries and mortalities greater than 1 percent of the PBR and therefore these two fisheries have not met the ZMRG for this stock and are in Category II. The mean annual number of Steller sea lions taken in the BSAI Atka mackerel, BSAI Pacific cod trawl, and GOA Pacific cod trawl fisheries range from 1.51 to 0.94 animals per year.

Since the majority of incidental takes in the groundfish fisheries occurs in the BSAI flatfish trawl and pollock trawl fisheries, a comparison of these TACs under each alternative provides an indication of potential effects. Under Alternative 1, the projected BSAI 2007 and 2008 TACs for flatfish and pollock are the same as projected under Alternative 2, and therefore the effects would be similar. BSAI pollock and flatfish TACs under Alternative 3 are lower than under Alternative 1 and 2, which may result in less potential for incidental takes. Because the BSAI flatfish trawl fishery is responsible for the majority of Steller sea lion incidental takes, Alternative 3 has the lowest potential for takes.

In 2007, Alternative 4 is projected to have higher flatfish TACs than Alternative 3, but close to the same flatfish TACs as Alternatives 1 and 2. This would result in more potential for incidental takes compared to Alternative 3 and about the same potential for incidental take as Alternatives 1 and 2. In 2008, the Alternative 4 BSAI flatfish TACs are higher than Alternative 3 but much lower than Alternatives 1 and 2. Pollock TACs in 2007 and 2008 under Alternative 4 are slightly lower than Alternatives 1-3. The lower pollock TAC in 2007 may offset the equivalent flatfish TACs compared to Alternatives 1 and 2 and may result in overall less potential for incidental takes of Steller sea lions under Alternative 4.

There is very little difference in the size of TACs for the Pacific cod and Atka mackerel fisheries among alternatives in 2007 and 2008. The pollock, Pacific cod, and Atka mackerel fisheries in the BSAI and GOA account for 7.48 animals of the 10.8 animals taken per year. The additional potential take of Steller sea lions in the flatfish fishery may be offset by the decreased potential take in the pollock, Pacific cod, and Atka mackerel fisheries because these fisheries together take more than twice as many Steller sea lions as the flatfish fisheries. In the GOA, pollock and Pacific cod TACs are very similar among Alternatives 1, 2, and 3. Alternative 4 has smaller GOA pollock and Pacific cod TACs compared to Alternatives 1, 2, and 3. Fewer incidental takes of Steller sea lions in the GOA would occur under Alternative 4 compared to Alternatives 1, 2, and 3.

Incidental takes of the eastern DPS of Steller sea lions are limited to the GOA sablefish longline fishery, with an annual mean mortality of 1.37 animals (Angliss and Outlaw 2005). The sablefish TACs are the same in 2007 and 2008 for Alternatives 1, 2, and 4. The Alternative 3 sablefish TAC is slightly less than Alternatives 1, 2, and 4. The total human caused mortality for the eastern DPS is approximately 0.5 percent of the PBR. Therefore, under Alternatives 1, 2 and 4, the GOA groundfish fisheries would result in similar, low levels of incidental take of the eastern DPS of Steller sea lions as seen in the past. Alternative 3 would result in a lower sablefish TAC and possibly a lower level of Steller sea lion take.

In the Aleutian Islands and GOA, incidental takes are often within Steller sea lion critical habitat. In the Bering Sea, takes are farther off shore and along the continental shelf. Otherwise, there seems to be no apparent "hot spot" of incidental catch disproportionate with fishing effort.

Cumulative estimated mortality and serious injury of the western DPS of Steller sea lions from State and Federal fisheries exceeds the ZMRG because it is greater than10 percent of the PBR. Under Alternatives

1, 2, 3 and 4, the groundfish fisheries alone would not be expected to cause enough mortality to exceed the PBR. However, the cumulative effect of total human-caused mortality (including subsistence takes) for the western DPS of Steller sea lions is approximately 94 percent of the PBR. Therefore, an increase in human-caused mortality may cause the PBR to be exceeded. The cumulative effect of total human caused mortality (including subsistence takes) for the eastern DPS is approximately 0.4 percent of the PBR.

A small amount of mortality may also occur during research activities under all alternatives. A review of the annual research permit reports from 2000 through 2005 determined that 0.8 animal per year from the western DPS and 3.3 animals per year from the eastern DPS were observed killed during research activities (Data from NMML, ADF&G, Oregon Department of Fish and Wildlife, and Alaska SeaLife Center. R. Angliss, pers. comm., August 7, 2006). This does not account for animals that may have died and not been observed. Research caused mortalities are not likely to result in the PBR being exceeded for either DPS under all alternatives.

Northern fur seal

The currently available data show that the minimum estimate of groundfish fishery-caused northern fur seal mortality and serious injury is well below the PBR of 1,967 animals and below the ZMRG for all fisheries. Reported incidental take is limited to the BSAI flatfish trawl fishery with an estimated annual mean mortality of 0.48 animals (Table 8-3). Because of the higher flatfish 2007 TACs, potential incidental takes of fur seals under Alternatives 1, 2, and 4 would be higher than under Alternative 3. In 2008, the BSAI flatfish TACs for Alternatives 1 and 2 are the same. Alternative 4 has a flatfish 2008 TAC less than Alternatives 1 and 2, and Alternative 3 has the smallest flatfish TAC. Potential incidental take of fur seals in 2008 is the least for Alternative 3, more for Alternative 4, and greatest for Alternatives 1 and 2.

In the past, northern fur seal were entangled in marine debris more often than any other species of marine mammals in Alaskan waters. However, discarded net debris from Alaskan groundfish fisheries appears to have declined over the past decade. The most common types of debris that result in entanglement are trawl net webbing, plastic packing materials, and monofilament line (NMFS 2006a). Because of their smaller size, juveniles and females have higher rates of entanglement than adult males. Recent studies of entanglement of juvenile male fur seals in the Pribilof Islands estimate the annual entanglement rate is less than 1 percent (NMFS 2006a). This estimate is likely low because it does not account for animals that become entangled at sea and do not return to land. Trites and Larkin (1989) estimated a 2 to 5 percent reduction in adult female survival based on available trend data. They note that this may contribute to the current decline of the fur seal population.

Higher trawling effort under Alternatives 1 and 2 may result in more lost gear that could pose a greater entanglement threat than under Alternatives 3 or 4.

The cumulative effect of total human caused mortality (including subsistence takes) for fur seals is approximately 6 percent of the PBR.

Northern elephant seals

The incidental take of northern elephant seals in the North Pacific fisheries is trivial (Barlow et al. 1993, 1994). Even though the stock assessment for northern elephant seals does not report the incidental take of northern elephant seals in the Alaska groundfish fisheries, the draft 2006 List of Fisheries shows that there is some incidental take in the GOA pollock trawl fishery (Table 8-4). The take of northern elephant seals in the GOA pollock trawl fishery appears to be a rare occurrence and groundfish fishery takes are below the ZMRG.

Alternatives 1, 2, and 3 have similar GOA pollock TACs projected for 2007 and 2008. These alternatives would result in higher TAC for GOA pollock and more potential for northern elephant seal takes compared to Alternatives 4. Because the alternative TACs are similar or less than historical harvests, none of the alternatives are expected to result in northern elephant seal takes that would be considered more than trivial.

The cumulative effect of total human caused mortality (including subsistence takes) for northern elephant seals is approximately 3 percent of the PBR.

Harbor seals

The latest stock assessment for harbor seals is dated 1998 (Angliss and Outlaw 2005). NMFS is currently working with the Alaska native community to redefine the stocks based on new genetic information and will develop new assessments for each stock. The stocks are currently divided among the Bering Sea, Southeast Alaska, and the Gulf of Alaska.

Based on 1990 through 1996 data, a very small amount of the total human annual mortality is attributed to the groundfish fisheries. The total groundfish fisheries take of harbor seals is 1 percent or less of the PBR, and no groundfish fishery exceeds the ZMRG.

The mean annual mortality in the GOA groundfish longline fisheries is 4 animals for the Southeast stock. The BSAI trawl fisheries and pot fisheries have a mean annual mortality of 2.2 and 1.2 animals, respectively for the Bering Sea stock. According to the List of Fisheries, the BSAI trawl fisheries that take harbor seals are the flatfish, pollock, and Pacific cod fisheries (Table 8-4). Because of the use of more recent data, the Pacific cod pot fishery is the only GOA fishery recorded on the List of Fisheries to take harbor seals (Table 8-4). Less than one animal per year is taken in the BSAI groundfish longline, GOA trawl, and GOA pot fisheries.

The BSAI flatfish and pollock trawl fisheries have more of an impact on the take of harbor seals than other fisheries, so these will be examined to compare potential takes under the alternatives. The levels of takes in 2007 and 2008 are expected to remain the same as in the past under Alternatives 1 and 2 because the flatfish, Pollock, and Pacific cod TACs are the same. In 2007, Alternative 3 has less TAC than Alternatives 1 and 2, but more than Alternative 4. Therefore it is likely that Alternative 3 in 2007 would have less potential for incidental takes than Alternatives 1 and 2, but slightly more than Alternative 4. In 2008, Alternative 4 has a slightly higher TACs than Alternative 3, and therefore, more potential for incidental takes of harbor seals.

Larger variations of TAC are seen among the alternatives for the GOA. In 2007 and 2008, the TACs are largest for Alternative 1, less for Alternative 2, and the least for Alternative 3, primarily due to differences in flatfish TACs. The GOA trawl fisheries accounted for 0.4 animals per year for the GOA stock (Angliss and Outlaw 2005). Alternative 1 would have the greatest potential for incidental takes with less potential for Alternative 2, and the least for Alternative 3.

Even though the harbor seal mortality in the groundfish fisheries is 1 percent or less of the PBR, the total human cause mortality is close to the PBR (Table 8-3; 50 to 95 percent of PBR). Because the total human caused mortality is close to the PBR, Alternative 1 for the GOA and Alternatives 1 and 2 for the BSAI pose the most concern for incidental takes. With the highest TACs among the alternatives, these pose the greatest potential for increasing incidental takes of harbor seals and may result in the total human-caused mortality to reach or exceed the PBR, especially for the GOA stock of harbor seals.

Spotted seals, bearded seals, ringed seals, ribbon seals, Pacific white-sided dolphin, and walrus

The population estimates for these marine mammals range from the tens of thousands to the hundreds of thousands (Angliss and Outlaw 2005). Except for Pacific white-sided dolphin, these species are not classified as strategic stocks under the MMPA because of the minimal interactions between these stocks and any U.S. fishery (Angliss and Outlaw 2005). They are not listed under the ESA.

Fisheries mortality is a very small amount of the total annual human caused mortality for these species (Table 8-3). No PBR is established for these species, and therefore it is not possible to determine the impact of takes on the sustainability of the populations using this criterion. Even though the PBRs are undefined, the take of the animals is small compared to the estimated populations. Therefore, the impact of the groundfish fisheries on these stocks is considered minor.

Take of spotted, bearded, ringed, and ribbon seals, and Pacific walrus have occurred in the BSAI pollock and flatfish trawl and Pacific cod longline fisheries (Table 8-4). The amounts of annual take range from 1.6 animals to less than 1 animal per year. Spotted seals are not listed in the SAR as taken in the groundfish fisheries, but are listed in the draft 2006 List of Fisheries as taken in the BSAI pollock trawl fishery. Because the SARs focus on the most recent 5 years of data, while the List of Fisheries reflects historical data, the inclusion of spotted seals in the List of Fisheries makes it clear that injuries or mortalities of spotted seals has occurred incidental to some component of the BSAI groundfish fisheries in the past.

Only one Pacific white-sided dolphin was taken in the BSAI trawl fisheries between 1989 and 2001 (Perez 2003), and one was taken in the BSAI longline fishery between 1994 and 1998 (Angliss and Outlaw 2005), compared to an estimated population of 26,880 animals. NMFS has changed the status of Pacific white-sided dolphin, North Pacific stock, from “strategic” to “not strategic”. There are no recent, reliable estimates of abundance and mortality/serious injury for this stock; however, white-sided dolphins have been seen during historical surveys in portions of the stock's range at densities that suggest sufficient numbers of dolphins to sustain the low levels of mortality that were previously estimated since the termination of high-seas driftnet fishing in 1991 (71 FR 42815; July 28, 2006).

The level of takes for these marine mammals under Alternatives 1 and 2 is expected to be similar to levels seen in the past based on the TACs for pollock, flatfish and Pacific cod. Pacific cod TACs are similar across the alternatives and therefore differences in potential for incidental take are likely more dependent on pollock and flatfish TACs. Alternatives 1 and 2 have higher 2007 and 2008 TACs for pollock than Alternatives 3 and 4 and may result in higher potential for incidental takes. In 2007 and 2008, Alternative 3 has lower flatfish TACs but slightly higher pollock TAC than Alternative 4. Because most of these species are taken primarily in the BSAI pollock trawl fishery (Angliss and Outlaw 2005), the lower pollock TAC may offset the higher flatfish TAC under Alternative 4, especially for the bearded and spotted seals which are listed as taken in both fisheries. Because the overall amounts of pollock TAC for 2007 and 2008 under Alternatives 3 and 4 are similar, the potential amounts of incidental takes are probably also similar.

Potential incidental takes of walrus are lowest under Alternative 3 because Alternative 3 flatfish TACs are lower than the other alternatives in 2007 and 2008. Walrus incidental takes may increase under Alternative 4 compared to Alternative 3 because they are reported taken only in the flatfish trawl fishery. Flatfish TACs under Alternatives 1, 2, and 4 are similar in 2007, but Alternative 1 and 2 2008 flatfish TACs are substantially larger than Alternative 4 and would present more potential for incidental takes of walrus in 2008.

Minke whales

Minke whales are not listed as a strategic stock under the MMPA, and no subsistence hunting occurs for this stock. These whales are considered common and very little take of this species occurs in the fisheries (Angliss and Outlaw 2005). The overall groundfish fisheries mortality and injury on minke whales is a very small proportion of the human caused mortality for this species. Takes in the BSAI groundfish trawl fisheries are estimated at 0.3 animals per year. The 2006 draft List of Fisheries identifies the pollock trawl fishery as taking minke whales (Table 8-4). Even though the PBR is unknown for this species, the take of animals is minimal compared to the estimated populations of 800 to 1,000 animals. The take of minke whales under Alternatives 1 and 2 during 2007 are expected to be similar to takes seen in the past because the pollock TAC would be the same. Potential takes of minke whales under Alternatives 3 and 4 would be less than under Alternatives 1 and 2 due to pollock TACs being lower, with Alternative 4 having the lowest potential for takes. Overall takes in 2008 are expected to be less under each alternative than in 2007 due to less pollock TAC in 2008 compared to 2007.

Harbor porpoise, Dall's porpoise, and killer whales

The BSAI and GOA transient stocks of killer whales, eastern north Pacific Alaska resident killer whales, and Dall's porpoise are not classified as strategic stocks because, based on the best scientific information available, the estimated level of human-caused mortality and serious injury is not known to exceed the PBR (Anglis and Outlaw 2005). NMFS has changed three stocks of harbor porpoise in the Alaska region (Southeast Alaska, GOA, and Bering Sea stocks) from "not strategic" to "strategic" stocks as a precautionary approach (71 FR 42815; July 28, 2006). Additionally, these stocks are not listed as depleted under the MMPA or listed as threatened or endangered under the ESA.

The overall groundfish fisheries mortality and injury on the Dall's porpoise and harbor porpoise is 0.4 to 0.3 percent of PBR for each species and does not exceed the ZMRG. The amount of take from all fisheries of the BSAI and GOA transient and Alaska resident killer whale stocks is 75 and 21 percent of PBR respectively and exceeds the ZMRG. All of the human-caused mortality for killer whales is attributed to the BSAI pollock, flatfish, Pacific cod and Greenland turbot fisheries (Tables 8-3 and 8-4). As mentioned above, the Greenland turbot fishery killer whale mortality is less than the ZMRG based on 2000-2004 data. Therefore, the fisheries of primary concern for killer whales are the pollock, flatfish and Pacific cod longline fisheries. Mortality of resident killer whales in the flatfish trawl does not involve interactions with gear; instead, killer whales feeding on discards near the vessel are getting killed by the ship's propeller.

A number of fisheries in Alaska overlap harbor porpoise distribution and may take porpoise; however, few fisheries have observer data for estimating mortality. Harbor porpoise have only been reported taken in the BSAI flatfish trawl fishery. In 2007, flatfish TACs under Alternatives 1, 2, and 4 are similar and are higher than under Alternative 3. Therefore, the amount of incidental take of harbor porpoise is expected to be the lowest under Alternative 3. In 2008, the flatfish TACs under Alternatives 1 and 2 are substantially higher than under Alternatives 3 and 4, with Alternative 3 having the lowest flatfish TAC. Therefore in 2008, the potential incidental take of harbor porpoise is similar under Alternatives 1 and 2, and less under Alternative 4, and least under Alternative 3.

Dall's porpoise only have been taken in the BSAI pollock trawl fishery. Based on pollock TACs in 2007 and 2008, Alternatives 1 and 2 have the same potential for incidental takes of Dall's porpoise, Alternative 3 has less potential, and Alternative 4 has the least potential.

Most of the incidental catch of transient killer whales has been in the BSAI pollock and Pacific cod longline fishery (Angliss and Outlaw 2005). Less than 10 percent of the average annual mortality is attributed to the flatfish fishery. Because little incidental take is attributed to the flatfish fishery and the Pacific cod TAC is similar among alternatives, a comparison of the pollock TACs provides more indication of potential takes. In the BSAI, Alternatives 1 and 2 may pose more potential for incidental takes for transient killer whales compared to Alternatives 3 and 4 because of the higher pollock TACs, with Alternative 4 having the lowest pollock TAC. Therefore the potential for incidental takes of transient killer whales in the BSAI is greatest under Alternatives 1, 2, and 3 and least under Alternative 4. Pollock TACs in 2008 are less under all alternative than in 2007 and would likely result in less potential for incidental takes of transient killer whales.

Resident killer whales have been taken in the BSAI flatfish trawl, BSAI Pacific cod longline, and BSAI Greenland turbot longline fisheries according to the draft 2006 List of Fisheries (Table 8-4). Because of the average of 0 animals per year taken in the BSAI Greenland turbot fishery based on 2000 through 2004 data, the TAC for this fishery is not likely to affect the level of incidental takes. In addition, Angliss and Outlaw (2005) list the BSAI pollock trawl fishery as taking Alaska resident killer whales. Resident killer whales are affected twice as much by the pollock trawl and Pacific cod longline fishery than the flatfish fishery (Angliss and Outlaw 2005). There is little change in the Pacific cod TACs between years and alternatives so the pollock TACs give a better indication of potential differences in incidental takes. The 2007 and 2008 pollock TACs are highest under Alternatives 1 and 2, followed by Alternative 3, and least for Alternative 4. Therefore, potential incidental takes are likely similar under alternatives 1 and 2, less under Alternative 3 and the least under Alternative 4. Pollock TACs in 2008 are less than in 2007 and provide less potential for incidental takes under all alternatives compared to 2007.

Sperm whales

Sperm whales are listed as endangered under the ESA and depleted under the MMPA. A PBR has not been determined for sperm whales. The fishery incidental take for sperm whale is based on an observation of one animal entangled in fishing gear from the GOA longline sablefish fishery in 2000. The whale was released with significant gear still attached, likely causing its death (Angliss and Outlaw 2005). The number of sperm whales in the eastern North Pacific has been estimated to be 39,200 animals (Barlow and Taylor 1998). A draft recovery plan for sperm whales is available for public review and comment (71 FR 38385, July 6, 2006 and http://www.nmfs.noaa.gov/pr/recovery/plans.htm). This plan identifies entanglement in fishing gear in locations other than Alaska as one threat to the recovery of sperm whale populations.

Male sperm whales are known to be attracted to groundfish fishing activities. In the GOA, sperm whales have been observed feeding off longline gear targeting halibut and sablefish (NMFS 2006c). Approximately 90 male sperm whales are believed to participate in this activity. The interaction with commercial longline gear may have an adverse impact on sperm whales due to entanglement even though no mortalities have been observed. On the contrary, the whales appear to have become more attracted to these vessels in recent years as reliable and easy sources of food. Researchers also have observed that the sperm whales predating on longline gear appear to be able to avoid becoming entangled (J. Straley, pers. comm., March 13, 2006). Research in the eastern Gulf of Alaska is ongoing to develop deterrents to predation by sperm whales on sablefish longlines (Straley et al. 2005) which may reduce potential for entanglement.

Because the sablefish TACs under Alternatives 1, 2, 3, and 4 are similar in 2007 and 2008 in the GOA, similar potential for entanglement as seen in previous years is likely for each of these alternatives. Alternatives 1, 2, and 4 have the same TAC for sablefish and therefore equal potential for incidental takes of sperm whales compared to each other. Alternative 3 has a slightly lower sablefish TAC and slightly less potential for incidental take compared to Alternatives 1, 2, and 4.

Humpback and fin whales

Humpback and fin whales are listed as endangered under the ESA and depleted under the MMPA. Fishery-caused incidental takes of these stocks do not exceed the PBRs, but are substantial percentages of the PBRs, especially for the western North Pacific stock of humpback whales. Incidental takes of western North Pacific stock of humpback whales in the groundfish fisheries are 38 percent of the PRB and exceeds the ZMRG. A draft recovery plan for fin whales is available for public review and comment (71 FR 38385, July 6, 2006 and http://www.nmfs.noaa.gov/pr/recovery/plans.htm). Entanglement in fishing gear in locations other than Alaska is identified as a threat to recovery for fin whales in this draft plan.

According to Angliss and Outlaw (2005), for the western stock of humpback whales, the estimated total human-related annual mortality of 0.69 animals is less than the PBR level for this stock, 1.3 animals. The estimated fishery-related mortality rate is based solely on mortalities that occurred incidental to the BSAI pollock trawl and the BSAI sablefish pot fisheries. For the central stock of humpback whales, the estimated annual mortality and serious injury rate from the groundfish fisheries for the entire stock (0.49 animals per year) is considered a minimum (Angliss and Outlaw 2005). It is unclear whether the total level of human-caused mortality and serious injury exceeds the PBR level (12.9) for the central stock. The estimated annual mortality and serious injury rate in Southeast Alaska (2.4, of which 1.7 was fishery-related, but not known to be groundfish fishery-related) is less than the PBR level calculated only for the Southeast Alaska portion of the population (3.0).

The incidental take of fin whales is limited to the GOA pollock trawl fishery. This single source of mortality results in an estimate of 3 mortalities in 1999, and an average 0.59 (95% CI = 0.20 - 1.55) mortalities over the 5-year period from 1999 to 2003 (Angliss and Outlaw 2005). This level of take is approximately five percent of PBR (Table 8-3).

Incidental takes of humpback and fin whales under Alternative 2 are not expected to be different from past amounts of take because the TACs are expected to be the similar. Very little difference among Alternatives 1 through 4 exists for BSAI sablefish, and therefore potential humpback and fin whales incidental take is more likely affected by the size of the BSAI and GOA pollock TAC. Alternative 1 and 2 would result in the highest TACs for the pollock fishery; and therefore, would pose the greatest potential for incidental takes of fin and humpback whales compared to Alternatives 3 and 4. Alternative 4 would have the lowest TAC for pollock and would provide the lowest potential for incidental takes compared to Alternatives 1, 2, and 3 for fin and humpback whales.

8.3.2 Harvest of Prey Species

BSAI and GOA groundfish fisheries' harvests of marine mammal prey species may limit foraging success through localized depletion and dispersion of prey, making it more energetically costly for foraging marine mammals to obtain necessary prey. Thus, the timing and location of fisheries relative to foraging patterns of marine mammals may be a more relevant management concern than total prey removals. The groundfish fisheries are known to harvest the key prey species of the following marine mammals: Steller sea lions, northern fur seals, harbor seals, spotted seals, sperm whales, and resident killer whales.

Steller sea lions

The harvest of prey species by the groundfish fisheries is recognized as a very important potential impact on Steller sea lions and was considered in detail in the 2001 SEIS and BiOp (and 2003 supplement) (NMFS 2001) and is addressed in the draft FMP-level BiOp and draft recovery plan for Steller sea lions, under development. The recovery plan and new FMP-level BiOp planned for 2007 will include a thorough review and synthesis of the information regarding potential impacts on prey by the commercial fisheries identified since the previous FMP-level BiOp and recovery plan. It is not know at this time if the more recent studies will change our understanding of Steller sea lion and groundfish fishery interaction. Until these new analyses of new information are completed, this EIS must depend on the analysis provided in the current FMP-level BiOp (NMFS 2000), the 2001 BiOp and its 2003 supplement, the 2001 Steller sea lion protection measures SEIS (NMFS 2001) and the PSEIS (NMFS 2004) (all available from http://www.fakr.noaa.gov/index/analyses/analyses.asp). Alternatives 1 through 4 include similar harvest strategies as the preferred alternative analyzed in the PSEIS and therefore the conclusions of the PSEIS apply to this action. PSEIS concluded that the impacts of overall harvest under the harvest strategy used by Alternatives 1 through 4 in this EIS were insignificant (NMFS 2004, page 4.9-252). Alternative 5 is outside the preferred alternative of the PSEIS.

Steller sea lion protection measures control the spatial and temporal harvest of groundfish species recognized as important prey to mitigate the potential for competition for prey with the groundfish fisheries. This is accomplished by a number of measures including an overall harvest control rule, seasonal apportionments of harvests, limits on the amount of harvests in areas important to foraging Steller sea lions and restrictions on fishing in certain portions of Steller sea lion critical habitat. The harvest specifications include the seasonal apportionments of TACs and do not affect the locations of fishing activities. The 2001 BiOp found that fishing within the constraints of the temporal and spatial dispersal of harvest under the Steller sea lion protection measures was not likely to result in jeopardy of extinction for Steller sea lions or adverse modification of their critical habitat (NMFS 2001, Appendix A).

Steller sea lion protection measures require the control of overall harvests of pollock, Pacific cod, and Atka mackerel, which are considered key Steller sea lion prey species (50 CFR 679.20(d)(4)). This insures that on a global scale, the groundfish fisheries do not remove too large of a portion of the available biomass which could potentially reduce foraging success. If the spawning biomass of a prey species is predicted to fall below 20 percent of its unfished spawning biomass, directed fishing for that species would be prohibited. The harvest control rule is analyzed in the Steller sea lion protection measures SEIS (NMFS 2001, Appendix A, 2001 BiOp). This potential effect is considered a moderate concern in the 2001 BiOp. The global harvest of pollock, Pacific cod, and Atka mackerel would be controlled by the harvest control rule for Alternatives 1 through 4. Therefore, no difference is expected between Alternatives 1 through 4 related to the overall harvest of prey species. No fishing under Alternative 5 would result in no impact on the overall prey biomass or on foraging success for Steller sea lions.

Because of the spatial and temporal dispersion and the overall control of harvests under the Steller sea lion protection measures, the harvests under Alternatives 1 through 4 should not cause competition for key prey species that are likely to constrain the foraging success of Steller sea lions to the point of causing an overall population decline.

Some recent studies of fisheries interaction are included below to provide a sample of the types of information being developed. Future analysis of the harvest strategies will have the ability to include new information that will be provided through the new FMP-level BiOp and completed recovery plan.

The NMFS Alaska Fisheries Science Center's Fishery Interaction Team (FIT) has been studying the Alaskan groundfish fishery interactions with Steller sea lions. For the past several years, the FIT has focused on studies of important prey items for Steller sea lions: Pacific cod, Atka mackerel, and pollock. FIT has an ongoing study of the trawl fishery effects on Steller sea lions near Kodiak Island. This study surveys pollock biomass in Chiniak and Barnabas Gullies before and after fishing; with Chiniak Gully used as the control. The objective is to measure fishery effects on pollock biomass in open and closed areas to determine possible localized depletion.

Another study involved using Pacific cod pots to sample the abundance of Pacific cod after trawling in the Cape Sarichef area from 2003 through 2005. The study concluded localized depletion is strongly dependent on the spatial and temporal scales examined. The study used the scales of 5 nm and 2 week time period. The results indicated that either the relative rate of exploitation off Cape Sarichef by the Pacific cod trawl fishery was low or the actual fishing effect occurred at different spatial and temporal scales. Tagging and biological work during the same study indicated that the Pacific cod were highly mobile over time scales shorter than two weeks. More information on the Pacific cod study is available from http://161.55.120.152/sslprojects/SSLProjects_Detail.cfm?ID=129.

Fritz and Brown (2005) have examined a portion of Steller sea lion critical habitat and found Pacific cod harvest rates 5 to 16 times greater within a certain portion of critical habitat than the overall harvest rate for the BSAI. This may be a concern for potential localized depletion of prey if the Pacific cod abundance available to Steller sea lions in the critical habitat area is not sufficient to support foraging.

The FIT also has conducted studies on local abundance and distribution of Atka mackerel in the Aleutian Islands. The objective of the Atka mackerel tagging study is to determine the efficacy of trawl exclusion zones as a management tool to maintain prey availability for Steller sea lions. Localized fishing may affect Atka mackerel abundance and distribution near sea lion rookeries. FIT used tagging experiments to estimate abundance and movement between open and closed areas to the Atka mackerel fishery. Atka mackerel are a highly aggregated species that inhabit areas with fast currents, such as passes between the Aleutian Islands. In Seguam Pass, the pattern of tag recoveries to date suggests that there are two general areas where Atka mackerel aggregate, one inside the trawl exclusion zone within the pass and another outside the trawl exclusion zone on the bank to the south of Seguam Island. Localized abundance within these general areas, however, is highly variable and dependent on currents (tidal cycles), daylight, moon phase, and food availability. More information regarding this research is available from the AFSC website at http://161.55.120.152/sslprojects/SSLProjects_Detail.cfm?ID=116.

The limited study by FIT on prey species disturbance indicates that local abundance of Pacific cod may be able to recover in a two week or less time period and therefore may not be impacted by trawling. The level of pollock and Atka mackerel harvest in areas used by foraging marine mammals may be more of a concern than the harvest of Pacific cod.

Northern fur seals

Studies on northern fur seal diets began with the work of Lucas (1899). The most extensive research was based on the pelagic sampling of over 18,000 fur seals between 1958 and 1974 (Perez and Bigg 1986). Of the fur seal stomachs collected, 7,373 contained food and an additional 3,326 had trace remains. Based on the frequency of occurrence, the diet consisted of 67 percent fish (34 percent pollock, 16 percent capelin, 6 percent Pacific herring, 4 percent deep-sea smelt and lantern fish, 2 percent salmon, 2 percent Atka mackerel, and no more than one percent eulachon, Pacific cod, rockfish, sablefish, sculpin, Pacific sand lance, flatfish, and other fish) and 33 percent squid (Perez 1990). These data showed marked seasonal and geographic variation in the species consumed. In the EBS, pollock, squid, and capelin accounted for about 70 percent of the energy intake. In contrast, sand lance, capelin, and herring were the most important prey in the GOA. However, no fur seal stomach samples have been collected following the decline in abundance of forage fish in the GOA after the regime shift in the mid 1970s.

The BSAI groundfish fisheries spatially and temporally overlap with northern fur seal foraging areas and likely compete with fur seals for prey, predominantly pollock and Pacific cod. The EIS for setting the annual subsistence harvest of Northern fur seals on the Pribilof Islands (NMFS 2005) identified the harvest of Northern fur seal prey by the BSAI groundfish fisheries as having the potential to have a conditionally significant cumulative effect when considered with the fur seal subsistence harvest. The EIS notes that the following factors lower the probability of adverse impacts stemming from spatial or temporal concentration of fisheries in northern fur seal foraging areas: (1) 45 percent of the catch from both fisheries occurs during the A season in winter when female and juvenile male fur seals are not commonly found in the areas fished; (2) the pollock fisheries do not target fish younger than 3 years of age, which is the size preferred by foraging fur seals; and (3) the Pribilof Islands Habitat Conservation Zone limits prey removals in waters surrounding the Pribilof Island rookeries. The EIS concludes that conditionally significant adverse effects could occur with changes in harvesting activity and/or concentration of harvesting activity in space and time, such as increased groundfish fishing in fur seal habitat during June through August. None of the alternatives considered in this EIS would increase fishing in fur seal habitat during the summer months.

Additional information has been developed regarding the potential impacts of the fisheries on fur seals, particularly regarding prey size and foraging location overlap with the groundfish fisheries. The following new information provides an indication that the size of prey may be the same for some foraging fur seals as pollock harvested by the fisheries and that some fur seals may forage outside of the Pribilof Island Habitat Conservation Zone. Therefore, the probability of adverse impacts from the fisheries may be higher than what was expected under the 2005 EIS for subsistence harvests of fur seals (NMFS 2005).

A recent study of prey sampling for northern fur seals on St. Paul and St. George islands shows that scat sampling alone may underestimate the size of prey (Gudmundson et al. 2006). A comparison of spew and scat samples showed that the scats indicated smaller prey than the spew samples. Spew samples contained parts from walleye pollock that are similar to the size targeted by commercial fisheries. Fur seals may depend on prey larger than previously thought which may mean that more competition between the pollock fishery and fur seals may exist.

The overlap of pollock harvest and foraging areas for female fur seals is also being studied (L. Fritz, pers. comm., June 22, 2006). In the summer from 1982 to 2004, pollock harvest was higher in the foraging area used by female fur seals from St. George Island compared to St. Paul Island. Lower pup production on St. George Island compared to St. Paul Island was also seen during this time period. After the implementation of the Steller sea lion protection measures, the pollock fishery moved away from the female foraging area. The cause of the decline in pup production has not been determined.

One study found that the juvenile male at-sea range can extend farther from the Pribilof Islands when compared with previous reports of parturient female at-sea range, thus revealing important variation within this species (Sterling and Ream 2004). Thirty-one juvenile male fur seals tagged on the Pribilof Islands had trip durations ranging from 8.7 to 28.8 days with trip distances from 171 to 681 km. Diving tended to reflect patterns associated with different bathymetric domains: shallow nighttime diving was common in water around 3000 meters deep, whereas deeper diving was generally observed in waters <200 m deep. Juvenile male fur seals can forage at greater maximum distances from the island of departure than lactating females.

Another study found that female fur seals from St. Paul and St. George islands tended to travel in different directions relative to their breeding site in both years of the study (Robson et al. 2004). St. Paul Island females dispersed in all directions except to the southeast, where St. George Island females foraged. Habitat separation was also observed among breeding areas on northeastern and southwestern St. Paul Island and to a lesser degree on northern and southern St. George Island. Although foraging direction led to geographical separation among sites, the maximum distance traveled and the duration of foraging trips did not differ significantly. The results of this study document that lactating fur seals from the same site share a common foraging area and females from different breeding sites tend to forage in separate areas and hydrographic domains.

Recent studies have used biochemical methods to study the diet of northern fur seals (NMFS 2004b). Kurle and Worthy (2000) used carbon and nitrogen isotope analysis of fur seal skin and whole prey to investigate the feeding ecology of female and juvenile male northern fur seals during the spring migration and of lactating female fur seals during the breeding season. Their results suggest that lactating females eat prey at trophic levels equivalent to 2 to 4 year-old walleye pollock and small Pacific herring during the fall. Nitrogen isotope ratios used to determine the trophic level of prey did not indicate a diet of juvenile pollock. During the northward spring migration, nitrogen isotope ratios indicated that the diet of both pregnant females and juvenile males consisted of prey at the same trophic level as capelin, herring, or adult pollock. Carbon isotope ratios suggested that migrating adult females fed in coastal areas while juvenile males and females were feeding further offshore. Using fatty acid signature analysis of fur seal milk to study the foraging patterns of lactating females on the Pribilof Islands, Goebel (2002) determined that prey of shallow-diving seals foraging off the continental shelf differs from shallow divers on-shelf, and that prey of deep diving females differs from both types of shallow divers. Milk of deep diving seals had fatty acid signatures most similar to fatty acid signatures of walleye pollock. The results of this study indicate that different dive patterns and foraging locations of lactating females likely result from exploitation of different prey resources. In waters over the continental shelf, adult walleye pollock are generally found near the bottom while juvenile pollock are usually concentrated in the surface layer above the thermocline (Bailey 1989) suggesting that the diet of deep diving fur seals in these areas includes adult pollock.

The direct and indirect relationship between fur seal growth and survival and the removal of prey by commercial fisheries and fishery bycatch is not understood (NMFS 2006a). The distribution and abundance of fish resources vary by area, season, and year depending on oceanographic conditions, success of recruitment of different cohorts of fish, and other factors. This variation, in concert with removals by commercial fisheries, need to be studied to understand the complex relationship between fur seal feeding behavior, growth, and survival. While the complexity of the fishery interaction and ecosystem may obscure findings, we must analyze fisheries removals and fur seal presence at similar times and at the appropriate spatial scales in order to evaluate the commercial fishery influence on fur seal food availability. Continuing and refining analyses of concurrent fur seal foraging data, prey availability, fisheries removals, and environmental data will assist in the development of appropriate fisheries management actions as interactions are better understood.

As discussed above, pollock is the only groundfish that makes up a substantial portion of the fur sea diet. Because evidence indicates that considerable overlap may exist between the size of pollock consumed by fur seals and pollock harvested in the groundfish fisheries, competition for prey species may exist if the groundfish fisheries and fur seals depend on the same area for removing prey. Studies relating fur seal population trends and commercial fisheries pollock removals have not been completed. Therefore, no information is available to indicate that potential levels of competition for pollock under each alternative may constrain the foraging success of northern fur seals at a level that would cause population decline. Alternatives 1 through 4 provide similar types of harvesting activities and harvest locations which may impact foraging success of fur seals and therefore, the impacts related to type of fishing and location in each alternative are similar. The only difference between the alternatives that may impact foraging success for fur seals is the pollock TAC. Assuming that spatial overlap between pollock harvest and foraging fur seals exists, Alternatives 1 and 2 would pose the greatest potential for competition based on the higher pollock TAC than the Alternatives 3 and 4. Alternative 4 would present the least potential for competition due to the lowest pollock TAC among Alternatives 1, 2, and 3. Alternative 5 would eliminate the potential competition with fur seals by not authorizing a groundfish fishery.

Harbor seals and spotted seals

Harbor seal diet includes pollock (12 percent) and Atka mackerel (9 percent) in the BSAI (NMFS 2004a). Although there is overlap in species/size classes taken by the groundfish fisheries and by harbor seals, seals also consume a large amount of other prey species and forage primarily in nearshore waters. Pollock is also a prey species for spotted seals throughout the year and in various life stages (NMFS 2004a). Pollock removals by fisheries are less than 10 percent of the biomass estimate and occur primarily in the EEZ, suggesting that in terms of volume and location, the unharvested fraction of pollock is sufficient to satisfy harbor seal foraging needs (NMFS 2004a).

No information indicates that the existing level of competition for pollock constrains the foraging success of harbor and spotted seals or causes population declines. Assuming that this spatial overlap may exist between groundfish fisheries and foraging harbor and spotted seals, Alternatives 1 and 2 would pose the greatest potential for competition based on the higher pollock and Atka mackerel TACs than Alternatives 3 and 4. Alternative 4 would present the least potential for competition due to the lowest pollock and Atka mackerel TACs among Alternatives 1, 2, and 3. Alternative 5 would eliminate potential competition with harbor seals by not authorizing fishing.

Sperm whales and resident killer whales

Based on information presented in the PSEIS (NMFS 2004a), sperm whales and resident killer whales compete with the longline groundfish fisheries. In the GOA, male sperm whales have been observed feeding off longline gear targeting halibut and sablefish. The whales appear to have become more attracted to these vessels in recent years as reliable and easy sources of food. In the BSAI, killer whales have been observed feeding off longline gear targeting sablefish and Greenland turbot. Consumption of other groundfish species by resident killer whales is largely unknown. The importance of groundfish as prey items for killer whales is unknown, but no evidence exists suggesting exclusive reliance on commercially important groundfish species.

No evidence suggests that groundfish harvests constrain foraging success of sperm whales or resident killer whales; therefore, the effects of Alternatives 1 through 4 are probably the same. Alternative 5 would eliminate potential competition with sperm whales and resident killer whales by not authorizing fishing. If sperm whales are dependent on the longline fishery for easy access to prey, Alternative 5 may make foraging more of a challenge. Likewise, higher TAC levels for sablefish under Alternatives 1, 2, and 4 may provide more opportunity to sperm whales to remove sablefish from longlines.

Other marine mammal species

Based on existing scientific information presented in the PSEIS (NMFS 2004a), the BSAI and GOA groundfish fisheries are not known to compete for key prey species with the following marine mammals: bearded seals, ringed seals, ribbon seals, walrus, northern elephant seals, transient killer whales, beluga whales, white-sided dolphins, Dall's porpoise, beaked whales, harbor porpoise, baleen whales, and sea otters.

However, groundfish fisheries do harvest small amounts of forage species in relation to biomass and may change predator and prey relationships in ways that we may not be able to understand. It is likely some minor effect may occur. Because much of the forage fish bycatch occurs in the pollock fishery, forage fish competition is more likely to occur with larger pollock TACs as under Alternatives 1 and 2.

8.3.3 Disturbance Effects

Vessel traffic, nets moving through the water column, or underwater sound may all affect marine mammal behavior. Foraging could be affected, not only by interactions between vessels and species, but also by changes in fish schooling behavior, distributions, or densities, in response to harvesting activities. In other words, disturbance of the prey may be as important as disturbance of the predator itself. For the purposes of this analysis, some level of prey disturbance may occur as a fisheries effect. The impact on marine mammals using those schools for prey is a function of both the amount of fishing activity and its concentration in space and time, neither of which may be extreme enough under any alternative to represent population level concerns. To the extent that fishery management measures impose limits on fishing activities inside critical habitat (for Steller sea lions), the Pribilof Island Habitat Conservation Zone (for northern fur seals), and the Bristol Bay no trawl zone (for sea otters and other marine mammals), protection is provided from these disturbance effects under all alternatives.

The level of disturbance is based on the location of fishing activities, and the species harvested, and on whether closed areas remain closed. Under Alternative 2, existing information indicates that current level of disturbance of marine mammals does not cause population decreases (NMFS 2004). Alternatives 1, 3, and 4 would not change fishery locations, the species harvested, or open areas currently closed to fishing. Alternative 1 in the GOA allows for substantially more flatfish fishing effort, which may result in more disturbance by increasing the amount of time vessels may be in contact with marine mammals as long as harvest is not constrained by PSC limits. Alternative 3 for the GOA has the lowest overall TAC and therefore the lowest potential for disturbance compared to Alternatives 1, 2, and 4. Disturbance potential in the BSAI are likely the same between Alternatives 1 and 2, and less under Alternatives 3 and 4, due to differences in available TAC. Alternative 5 would eliminate the adverse effects of fishing because there would be no interaction between marine mammals and vessels fishing for groundfish.

8.4 Reasonably Foreseeable Future Actions that may Affect the Impacts of the Alternatives on Marine Mammals

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the effects of the alternatives on marine mammals. These actions are described in Chapter 3.

Ecosystem-sensitive management

Increased attention to ecosystem-sensitive management is likely to lead to more consideration for the impact of the groundfish fisheries on marine mammals and more efforts to ensure the ecosystem structure that marine mammals depend on is maintained, including prey availability. Increasing the potential for observers collecting information on marine mammals and groundfish fisheries interaction, and any take reduction plans, may lead to less incidental take and interaction with the groundfish fisheries, thus reducing the adverse effects of the groundfish fisheries on marine mammals.

Changes in the status of species listed under the ESA, the addition of new listed species or critical habitat, and results of future Section 7 consultations may require modifications to groundfish fishing practices to reduce the impacts of these fisheries on listed species and critical habitat. Designating a separate species listing for northern right whales requires a reinitiation of Section 7 consultation for the groundfish fisheries, if activities may affect the newly described northern right whale species. The consultation would identify any right whale protection measures needed for the groundfish fisheries. This potential future action is likely to increase protection for northern right whales.

Modifications to Steller sea lion protection measures may result in Section 7 consultations. These changes may be a result of recommendations by the Council based on a review of the current protection measures, potential State actions, recommendations of the Steller sea lion Recovery Plan, or recommendations from the FMP level biological opinion. Any change in protection measures likely would have insignificant effects because any changes would be unlikely to result in the PBR being exceeded.

Future actions for improved management of fur seals may result from the increased concern demonstrated by the Council in the formation of the Fur Seal Committee, and the continued development of information regarding groundfish fishery interactions and fur seals. The timing and nature of potential future protection measures for fur seals are unknown, but any action is likely to reduce the adverse effects of the groundfish fisheries on fur seals.

Fisheries Rationalization

Many of the resulting changes to the prosecution of the fisheries under rationalization would potentially reduce the impacts of fisheries on marine mammals. Future rationalization of the groundfish fisheries is expected to reduce fishing effort and improve manageability of the fisheries through better harvest and bycatch controls. A rationalization program would reduce the number of vessels that participate in the groundfish fisheries, thus decreasing the potential for incidental take, reducing the amount of marine debris, and reducing vessel disturbance. A rationalization program also would potentially reduce the effects of the fisheries on marine mammals by providing fishermen the time to improve fishing practices and avoid sensitive areas, such as rookeries. Increases in monitoring and observer coverage from implementing a rationalization program would increase our understanding of the impacts of these fisheries on marine mammals by providing better incidental take information and fishery locations. To the extent that the implementation of fisheries rationalization will likely result in reduced effort or modified fishing, the impacts of the proposed action will be reduced.

Traditional management tools

The cumulative impact of the annual harvest specifications in combination with future harvest specifications may have lasting effects on marine mammals. However, as long as future incidental takes remain at or below the PBR, the stocks will still be able to reach or maintain their optimal sustainable population. Additionally, since future TACs will be set with existing or enhanced protection measures, it is reasonable to assume that the effects of the fishery on the harvest of prey species and disturbance will likely decrease in future years. Improved monitoring and enforcement through the use of technology would improve the effectiveness of existing and future marine mammal protection measures by ensuring the fleet complies with the protection measures, and thus, reducing the adverse impacts of the alternatives.

Actions by other Federal, State, and International Agencies

Expansion of State pollock fisheries may increase the overall effects on marine mammals. However, due to ESA requirements, any expansion of State groundfish fisheries may result in reductions in Federal groundfish fisheries to ensure the total removals of these species does not jeopardize any ESA-listed species or adversely modify designated critical habitat, including Steller sea lions.

Private actions

Subsistence harvest is the primary source of direct mortality for many species of marine mammals. Current levels of subsistence harvests, reflected in column 3 and footnotes of Table 8.3, are controlled only for fur seals and bowhead whales. Subsistence harvest information is collected for other marine mammals and considered in the stock assessment reports. Subsistence harvests of marine mammals may or may not continue at current rates for the foreseeable future.

Other factors that may impact marine mammals include continued commercial fishing; non-fishing commercial, recreational, and military vessel traffic in Alaskan waters; and tourism and population growth that may impact the coastal zone. Little is known about the impacts of these activities on marine mammals in the GOA and BSAI. However, Alaska's coasts are currently relatively lightly developed, compared to coastal regions elsewhere. Despite the likelihood of localized impacts, the overall impact of these activities on marine mammal populations during the period under consideration is expected to be modest.

Conclusions

The continuing fishing activity and continued subsistence harvest are potentially the most important sources of additional annual adverse impacts on marine mammals. Both of these activities are monitored and are not expected to increase beyond the PBRs for most marine mammals. The extent of the fishery impacts would depend on the size of the fisheries, the protection measures in place, and the level of interactions between the fisheries and marine mammals. However, a number of factors will tend to reduce the impacts of fishing activity on marine mammals in the future. These include the trend towards ecosystem management and fisheries rationalization. Ecosystem-sensitive management and institutionalization of ecosystem considerations into fisheries governance are likely to increase our understanding of marine mammal populations. Fisheries rationalization may lead to reduced interactions to the extent that fewer operations remain in a fishery, and the remaining operations are better able to comply with protection measures. The effects of actions of other Federal, State, and international agencies are likely to be less important when compared to the direct interaction of the commercial fisheries, subsistence harvests, and marine mammals.

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Chapter 9 Impacts on Seabirds

9.1 The Seabird Resource

The seabird resource includes the seabird populations that nest within or migrate into and spend time within the action area. The PSEIS describes the seabird species listed in Table 9-1 in the action area (NMFS 2004, pp. 3.7-18 to 3.7-87).

Table 9-1 Species included in the seabird resource

Albatrosses • Black-footed • Short-tailed • Laysan	Gulls • Glaucous-winged • Glaucous • Herring • Mew • Bonaparte's • Sabine	Murres • Common • Thick-billed
Northern fulmar	Jaegers • Long-tailed • Parasitic • Pomarine	Guillemots • Black • Pigeon
Shearwaters • Short-tailed • Sooty	Eiders • Common • King • Spectacled • Steller's	Murrelets • Marbled • Kittlitz's • Ancient
Storm petrels • Leach's • Fork-tailed	Kittiwakes • Black-legged • Red-legged	Auklets • Cassin's • Parakeet • Least • Whiskered • Crested
Cormorants • Pelagic • Red-faced • Double-crested	Terns • Arctic • Aleutian	Puffins • Rhinoceros • Horned • Tufted

Three species of seabirds in the action area are listed under the Endangered Species Act. These are the endangered short-tailed albatross (*Phoebastria albatrus*), the threatened spectacled eider (*Somateria fisheri*), and the threatened Steller's eider (*Polysticta stelleri*). The Kittlitz's murrelet (*Brachyramphus brevirostrus*) became a candidate for listing in May 2004. (See Section 3.4 of this EIS; C. Kuletz, pers. comm.) In September 2004, the USFWS received a petition to list the black-footed albatross as threatened or endangered under the ESA. The petition is under review at this time (S. Fitzgerald, pers. comm., 2006; Melvin et al. 2006). Conservation concerns over black-footed albatross have risen in recent years. Melvin et al. note that the World Conservation Union changed the conservation status of the black-footed albatross from its vulnerable rating to its endangered rating in 2003. (Melvin, et al. 2006, p. 4).

ESA-listed seabirds are under the jurisdiction of the USFWS, which has completed biological opinions (BiOps) at the FMP-level (USFWS 2003b) and project-level (USFWS 2003a) for the groundfish fisheries and the setting of annual harvest specifications. Both BiOps concluded that the groundfish fisheries and the annual setting of harvest specifications were unlikely to cause the jeopardy of extinction, or the adverse modification or destruction of critical habitat for ESA-listed seabirds.

For this analysis, seabirds have been grouped as follows:

- northern fulmar,
- short-tailed albatross,
- spectacled and Steller's eiders,
- albatrosses and shearwaters,
- piscivorous seabird species, and
- all other seabird species not already listed.

This grouping follows the approach used in the Steller sea lion EIS (NMFS 2001, pp. 4-236):

- Impacts on the northern fulmar are considered separately because this species accounts for the vast majority of incidental take that occurs in the hook-and-line fisheries of the BSAI and GOA and is one of the most abundant species that breeds in Alaska colonies.
- Short-tailed albatross is listed separately because of the special management concerns for animals listed under the ESA, and because of the precarious state of the population.
- Spectacled eider and Steller's eider are considered separately from other seaducks, because of special ESA management concerns, and because, except for considerations of critical habitat, the impacts on other seaducks such as scoters, long-tailed ducks, and harlequin ducks would be similar to the impacts on these two eider species.
- The other seabird species or species groups with the greatest potential for interactions with Alaskan groundfish fisheries are albatrosses and shearwaters (migratory birds that do not breed in Alaska) and Piscivorous seabird species (fish-eating seabirds that do breed in Alaska, including murres, kittiwakes, gulls, rhinoceros auklets, puffins, cormorants, jaegers, terns, guillemots, and murrelets). Each of these groups has been considered as a separate group.
- All other seabird species not listed above, such as storm-petrels, crested auklet, and least auklet, are considered as a separate group.

More information on seabirds in Alaska's EEZ may be found in several NMFS, Council, and USFWS documents (all links were tested on July 8, 2006):

- The USFWS has primary seabird management responsibilities in Alaska. The URL for the Migratory Bird Management program web page is at: http://alaska.fws.gov/mbsp/mbm/index.htm
- Section 3.7 of the Groundfish Programmatic Supplemental EIS provides background on seabirds and their interactions with the fisheries. This may be accessed at http://www.fakr.noaa.gov/sustainablefisheries/seis/final062004/Chaps/chpt_3/chpt_3_7.pdf
- The annual Ecosystems Considerations chapter of the SAFE reports has a chapter on seabirds. Back issues of the Ecosystem SAFE reports may be accessed at http://www.afsc.noaa.gov/REFM/REEM/Assess/Default.htm and the 2006 issue may is available at http://access.afsc.noaa.gov/reem/ecoweb/index.cfm
- The Seabird Fishery Interaction Research webpage of the AFSC: http://www.afsc.noaa.gov/refm/reem/Seabirds/Default.htm
- The NMFS Alaska Region's Seabird Incidental Take Reduction webpage: http://www.fakr.noaa.gov/protectedresources/seabirds.html
- The BSAI and GOA Groundfish FMPs each contain an "Appendix I" dealing with marine mammal and seabird populations that interact with the fisheries. The FMPs may be accessed from the Council's home page at http://www.fakr.noaa.gov/npfmc/default.htm
- Washington Sea Grant has several publications on seabird takes, and technologies and practices for reducing them: http://www.wsg.washington.edu/publications/online/index.html .

The alternative harvest strategies considered here are evaluated with respect to impacts on three indicators of seabird resource health:

- *Take:* Seabirds can be killed and injured when they are attracted to baited hooks as these are being set and become entangled in the line or caught on the hooks. They are taken when they are attracted to trawling operations, perhaps by the presence of offal discards from fishing operations. They may become entangled in the cables connecting the trawl or the trawl sonar to the vessel, or in the trawl mesh. Hook-and-line and trawl gear account for most seabird take; pot gear for very little take. Indirect takes may occur if seabirds ingest and become entangled in marine plastics, become oiled during oil spills caused by marine accidents, or their colonies are predated by invasive mammals introduced by accident (the Norway rat is a particular concern).
- *Prey availability:* Fisheries may reduce, or disperse, the biomass of prey species available to seabird populations. Vessel activity may also displace or interfere with normal seabird foraging. This may be a particular concern when both birds and vessel are attracted by particular "hot spots" such as sites of upwelling, fronts, and shelf breaks. Vessels may also create seabird feeding opportunities by the discard of fish or fish processing wastes (offal).
- *Benthic habitat used by seabirds:* Fishing gear may disturb bottom habitat used by bottom feeding seabirds, reducing available prey. Bottom trawl gear is the primary source of concern for an indirect impact through benthic habitat disturbance (see Chapter 10).

Because the action is applied throughout the BSAI and the GOA and individual colony impacts are difficult to relate to overall population impacts, the impacts on most seabirds are analyzed in terms of impacts on the population.

The exception to the population focus is ESA-listed eiders that have critical habitat designated. Because critical habitat has been identified separately for these species, impacts on benthic habitat may be considered at the colony level. Impacts to individual colonies of ESA-listed species are more likely to result in population level impacts than colony impacts to unlisted seabirds. The USFWS collects reproduction and population information for selected colonies for many seabird species (USFWS 2003b). The population trends are specific to the colonies and may or may not be representative of the overall population trend in the BSAI and GOA, as population trends for a species in a particular year on several colonies may differ. Because the ESA populations are reduced compared to other seabirds and overall population information is available for ESA-listed species, information at the colony level for ESA-listed species is more likely to be understood in terms of overall population trends.

Since the preparation of the last NEPA analysis for annual groundfish harvest specifications (in February 2006), the following relevant new information has become available:

- Estimates of seabird bycatch totals for different gears in the BSAI and GOA for 2004 (NMFS 2006).
- Estimates of trawl bycatch that reduce the uncertainty about the actual level of bycatch (NMFS 2006).
- Better estimates of the number of longline hooks fished in 2004 (NMFS 2006).
- New evidence on the distribution of seabirds on Alaskan longline fishing grounds (Melvin et al. 2006).

9.2 Analysis of Impacts on Seabirds

Incidental take

Seabirds incidental take occurs when birds are attracted to baited longline hooks as these are being set, and become entangled in the gear or caught on the hooks. Average longline bycatch from 1993 to 2004 was about 12,300 seabirds in the BSAI, and about 900 in the GOA. In the BSAI, 58 percent of the bycatch was fulmars and 20 percent gulls. In the GOA, 45 percent of the bycatch was fulmars and 35 percent albatrosses (NMFS 2006; S. Fitzgerald pers. comm.).

Despite increasing groundfish longline[12] effort as measured by numbers of hooks, aggregate longline bycatch of seabirds has tended to decline since 1998. To some extent the effort increases in recent years have been offset by declines in effort in the AI. However, more importantly, the increasing effort levels in recent years have tended to be more than offset by decreasing seabird bycatch rates, leading to generally declining longline seabird bycatch. The bycatch rate (birds per 1,000 hooks) has also tended to decline since 1998. (NMFS 2006, pp. 17-19). For the demersal groundfish longline (all areas combined) fleet, the annual average seabird bycatch from 1993 through 2001 was 15,888. The average annual seabird bycatch from 2002 through 2004 was 4,910, a 70 percent reduction (S. Fitzgerald, pers. comm.).

The reasons for the declining bycatch rates are not well understood. They may be due, in part, to the introduction of new measures for reducing bird contacts with longline gear. Research at the Washington Sea Grant Program found that streamer lines are effective in reducing longline seabird bycatch (Melvin et al. 2001). Many freezer-longliner operations voluntarily adopted these measures starting in 2002. (NMFS 2005a, pp. 233-235; C. Coon, pers. comm.; S. Fitzgerald, pers. comm.). Revised bycatch avoidance measures have been required in the hook-and-line groundfish fisheries of the BSAI and GOA since February 12, 2004. These regulations require all hook-and-line vessels over 55 ft length overall to use paired streamer lines (69 FR 1930, January 13, 2004).

Estimated takes of seabirds by trawl gear are much smaller than estimates of longline takes. Average annual trawl takes from 1993-2004 were 855 seabirds in the BSAI, and 63 in the GOA. Gulls,

[12] Here and elsewhere in this discussion, longline refers to groundfish longline activity (targeting Pacific cod, Greenland turbot, and sablefish). A halibut longline fishery also exists in the GOA and BSAI.

shearwaters, and fulmars were the key species taken, accounting for 78 percent of the average annual trawl bycatch (all areas combined). These estimates are for birds brought up in trawl nets, and do not include potential mortality from entanglement or collision with in trawl cables. Some seabirds (fulmars and shearwaters) have been observed colliding with trawl warp and third wire cables with no apparent ill effects. Larger-winged seabirds such as albatross may be more susceptible to injury or mortality from collisions. (S. Fitzgerald, pers. comm., 2006).

The trawl mortality estimates described above are based on sampling the contents of the trawl nets. Anecdotal evidence indicates that additional seabird mortalities occur from entanglement or collision with the trawl sonar cable and main net cables. A special project for observers was implemented in 2004 to record entanglements in a more systematic fashion. That work was expanded in 2005 and continued for 2006. The AFSC is integrating this data with information on trawl and trawl sonar effort to develop information on interaction rates and mortality. Research was conducted in the summer of 2003 by the Pollock Conservation Cooperative so that industry could gain a better sense of these interactions, and in 2004 the PCC coordinated their efforts with the Washington Sea Grant Program. During this time, the PCC and two fishing companies were involved in a NMFS Cooperative Research Program with the AFSC to develop seabird mitigation measures for pollock catcher processors. In 2005 these organizations collaborated with Washington Sea Grant, who conducted a study of the effects of three devices versus a control of no measures. These efforts will help us to understand the species involved in certain areas and the encounter and mortality rates. In addition, there is research underway into electronic monitoring of seabird trawl interactions (McElderry et al. 2004, Melvin et al. 2004, Ames et al. 2005; S. Fitzgerald, pers. comm.).

Only small numbers of seabirds have been taken with pot gear. The average annual estimated bycatch with pot gear from 1993 to 2004 was 55 birds. Northern fulmar comprised the majority of the take (NMFS 2006; S. Fitzgerald, pers. comm., 2006). Pot gear is not considered further in this analysis because it takes very small numbers of seabirds.

The PSEIS summary of the available information on takes and their effects on seabird populations in the BSAI and GOA, suggests that the estimated seabird bycatch is low relative to seabird populations. Information on total seabird takes is based on extrapolations of observer samples of catches and bycatches. Information on vessel strikes is limited, and for trawlers, the data do not include potential mortalities from interactions with trawl cables or “third wires.” Population estimates are likewise very rough. The PSEIS compared takes from the 1990s and early 2000s to population estimates from early 2002 and made the following conclusions:

- Fulmar mortality was estimated to be less than one percent of the BSAI and GOA population (NMFS 2004, p. 4.9-233).
- No shorttailed albatross have been taken in the BSAI and GOA groundfish fisheries since 1998 (NMFS 2004, p. 4.9-225).
- Spectacled and Steller’s eider takes are “at levels approaching zero” (NMFS 2004, p. 4.9-247).
- Other albatross and shearwater takes are less than one percent of the populations at risk (NMFS 2004, p. 4.9-231).
- Bycatch of piscivorous red-legged kittiwakes, and Marbled and Kittlitz’s murrelets is rare, (and in the case of murrelets may approach zero). Bycatch of other piscivorous species, including alcids, gulls, and cormorants, are all low compared to populations sizes (NMFS 2004, pp. 4.9-237, 240).
- Takes of other seabirds, including storm-petrels and auklets, are also low compared to population levels (NMFS 2004, p. 4.9-244).

- For some species, such as spectacled eiders, Steller's eiders, and cormorants, there is little overlap between seabird habitat and the location of groundfish operations (NMFS 2004, pp. 4.9-240, 247).

AFSC estimates of seabird bycatch for all areas off Alaska (AI, BS, GOA), and all groundfish fisheries, extrapolated from observer data, provide a useful supplement to the information summarized in the PSEIS. Bycatch estimates from 2000-2004 are summarized in Table 9-2 below.

Table 9-2 AFSC estimates of Alaska seabird takes, 2000-2004

Species or species group	Low year take	Average yearly take	High year take
Shorttailed albatross	0	0	0
Laysan albatross	218	305	478
Blackfooted albatross	61	96	157
Unidentified albatross	3	9	31
Northern fulmar	4,756	5,439	6,401
Shearwaters	409	532	830
Unidentified procelarids	51	67	86
Gulls	2,307	2,569	2,937
Alcids	22	74	293
Other seabirds	24	35	59
Unidentified seabirds	691	860	1,163
Totals	9,085	9,986	11,165

Source: NMFS 2006; S. Fitzgerald, pers. comm. Note that these estimates do not include estimates of takes from trawl warp or third wire interactions.

These estimates do not include estimates of bird mortality from trawl cable interactions. Only anecdotal information was available prior to 2004. Observer information on trawl cable and third wire mortality has been available as anecdotal information since 1993. A special project was implemented in 2004 to record mortalities from entanglements. That project was expanded in 2005 and continued through 2006. The AFSC is currently working to integrate these observations with information about total trawl and trawl sonar effort in order to prepare better estimates of mortalities. The AFSC is also involved in a collaborative project with the Pollock Conservation Cooperative and Washington Sea Grant to develop methods to mitigate seabird-cable interactions. (NMFS 2006, p. 4; S. Fitzgerald, pers. comm.)

There are several sources of indirect incidental take associated with fishing activity. The potential impact of these sources of take on seabirds cannot be quantified:

- Observers have reported birds striking vessels while in flight. In some instances these strikes may kill or injure birds. Strikes may be more common at night or in fog when birds are attracted to vessel lights, and when vessels are operating near seabird colonies. Storm-petrels, auklets, and shearwaters may be most at risk from this source of mortality. Eiders, primarily king and common eiders, may also be susceptible (NMFS 2004, p. 3.7-11; K. Kuletz, pers. comm.).
- Mortality may occur if birds become fouled with oil from a spill. Oil can (a) reduce the insulating value of a bird's feathers and increase foraging requirements because of increased energy loss, (b) reduce a bird's buoyancy and ability to dive or fly, (c) poison a bird as it tries to clean itself, (d) interfere with reproduction, and (e) degrade bird habitat. Major oil spills are a concern. However, "chronic" spills associated with normal operations, such as fuel transfer and

bilge cleaning, can also be a concern. Diving seabirds like alcids and diving ducks may be most at risk from oiling (NMFS 2004, p. 3.7-15).

- Birds may be placed at risk by discarded plastics from fishing operations. Birds believed to be most at risk include the Order Procellariiformes (includes petrels, shearwaters, and albatrosses) and the parakeet auklet (NMFS 2004, p. 3.7-17).
- The introduction of Norway rats to islands with colonies of seabirds, particularly to islands with colonies of burrowing or cliff/crevice dwelling seabirds, can lead to declines in seabird populations and to potential extinction of colonies. Rats could be introduced to an island during a visit by a fishing vessel, or during a shipwreck. Species that may be most at risk from Norway rat predation include ancient murrelets, storm petrels, kittiwakes, murres, puffins, and auklets (NMFS 2004, p. 3.7-16).

The impacts of changes in groundfish TACs on seabird takes are difficult to predict. In the absence of models relating TACs to fishing behavior and fishing behavior to seabird takes, it is necessary to do a largely qualitative analysis. The analysis summarized in Table 9-3 draws on the information provided in the PSEIS, supplemented by the estimates of takes in fisheries during the most recent 5-year period summarized in Table 9-2 above. Values from Table 9-2 have been used to characterize the impacts of the Alternative 2 status quo harvest strategy.

Table 9-3 Impacts of the alternatives on seabird take

	A1	A2	A3	A4	A5
Northern fulmar	A small increase in fulmar takes. Over 90% of fulmars are taken in the BSAI, where there would be no increase in TACs. Possible increased likelihood of indirect takes in GOA.	There is a high likelihood of a status quo take between 4,800 and 6,400 fulmars. This is very small compared to a population of millions of birds. Indirect takes unknown.	Take below Alternative 2 levels and small compared to population size. Indirect take may be less than A2.	Take below Alternative 2 levels and small compared to population size. Indirect take may be less than A2.	No direct or indirect takes.
Short-tailed albatross	No direct take; possible increased likelihood of indirect takes in GOA.	No direct take; indirect take unknown.	No direct take. Indirect take may be less than A2.	No direct take. Indirect take may be less than A2.	No direct or indirect takes.
Spectacled and Steller's eiders	Take and indirect take levels approaching zero. No increase over A2 levels because BSAI TACs are not expected to be higher under this alternative.	Take levels approaching zero; indirect take unknown.	Take levels approaching zero. Indirect take may be less than A2.	Take levels approaching zero. Indirect take may be less than A2.	No direct or indirect takes.

Albatrosses and shearwaters	Modest increases in takes over A2 for Laysan albatross and shearwaters because most takes currently occur in the AI and EBS where TACs would not change. Possible increased likelihood of taking blackfooted albatross, which are taken primarily by longline fishermen in GOA.	High likelihood of a take between 300 and 700 albatross, 400 to 800 shearwaters. Take is small compared to populations. Indirect take unknown.	Take below Alternative 2 levels and small compared to population size. Indirect take may be less than A2.	Take below Alternative 2 levels and small compared to population size. Indirect take may be less than A2.	No direct or indirect takes.
Piscivorous seabirds	Possible increase over A2 levels, but expected to remain low compared to populations. Possible increased likelihood of indirect takes in GOA.	Bycatch of red-legged kittiwakes, and Marbled and Kittlitz's murrelets is rare, and may approach zero for murrelets; alcid (20-300), gulls (2,300 to 2,900) are small compared to populations. Indirect take unknown.	Take below Alternative 2 levels and small compared to population size. Indirect take may be less than A2.	Take below Alternative 2 levels and small compared to population size. Indirect take may be less than A2.	No direct or indirect takes.
All other seabirds	Possible increase over A2 levels, but expected to remain low compared to populations. Possible increased likelihood of indirect takes in GOA.	Under 100 and low compared to populations. Indirect take unknown.	Under 100 and low compared to populations. Indirect take may be less than A2.	Under 100 and low compared to populations. Indirect take may be less than A2.	No direct or indirect takes.

Note that the estimates above do not include some 700 to 1,200 unidentified seabirds; moreover they do not include estimates of seabirds taken by contact with trawl cables.
Sources: NMFS (2006)

Prey availability

Fisheries management measures affecting abundance and availability of forage fish or other prey species can affect seabird populations. Seabirds feed on a variety of fish species in the water column and in the benthic habitat. Groundfish fishing operations may target some of these species, and take others as bycatch, thereby reducing the supply of forage foods. By selectively harvesting certain species, groundfish operations may impact predator-prey relationships and seabird prey availability. Groundfish operations that alter benthic habitat may change its productivity and impact prey availability as well. Groundfish operations may fish down the food chain from larger predator species to smaller forage species that constitute seabird prey.

Section 3.7.1 of the PSEIS describes the impacts of prey abundance and availability on seabirds (NMFS 2004). There is considerable uncertainty about the mechanisms by which groundfish fishing can impact seabird prey and prey availability, and consequent impacts on seabird populations.

In the absence of a model permitting an analysis of a change in fishing mortality on forage available for seabirds, and an analysis of the impact of changes in forage availability on seabird populations, it is necessary to depend on more qualitative judgments to analyze the impacts of groundfish fishing on prey availability. The following conclusions depend primarily on scientific judgments summarized in the groundfish PSEIS:

- Northern fulmars "forage over vast areas of ocean on prey that are taken in very small amounts by the groundfish fisheries and which do not appear to be affected on an ecosystem level by the groundfish harvest" (NMFS 2004, p. 4.9-234).
- Short-tailed albatross, likewise, forage widely over the ocean and on species taken in small amounts by the groundfish fisheries (NMFS 2004, p. 4.9-225).
- There is little overlap between the groundfish fisheries and the foraging areas of the spectacled eiders and the Steller's eiders (NMFS 2004, p. 4.9-247).
- Albatrosses and shearwaters "forage over vast areas of ocean on prey that are taken only in negligible amounts by the groundfish fisheries and which do not appear to be affected on an ecosystem level" (NMFS 2004, p. 4.9-229).
- Among the piscivorous seabirds, the species and size classes of fish eaten by red-legged kittiwakes are taken in "negligible" quantities in the groundfish fisheries and there is little overlap between marbled and Kittlitz's murrelets foraging areas and the groundfish fisheries (NMFS 2004, p. 4.9-237). While there may be some overlaps between groundfish fishing and foraging areas for most alcids and gulls during the breeding season, these species have the ability to forage far from their colonies, which minimizes the potential for localized depletion. Moreover, they tend to forage on species and size classes that are not targeted by the groundfish fisheries (NMFS 2004, p. 4.9-241). Guillemots and cormorants forage less widely, and may be susceptible to localized depletion of prey (NMFS 2004, p 3.7-72).
- Other seabirds, including storm-petrels and auklets, target species and size classes of prey that are not the subject of directed fisheries. These seabirds could be affected by ecological influences (changes in predator-prey balance due to groundfish harvests), but "fluctuations in this food source are probably more closely related to fluctuations in environmental conditions than predator/prey relationships" (NMFS 2004, p. 4.9-245).

The BSAI and GOA FMPs define a category of non-target forage fish species. As noted in the discussion of forage fish in Chapter 6, bycatch of these forage fish species consists almost entirely of smelt, taken in directed trawl fisheries for pollock. Forage fish bycatch appears to be relatively small compared to biomass. Regulations at 50 CFR 679.20(i) prohibit directed fishing for, and the sale of, forage fish species, except for maximum retainable bycatch amounts, which may be made into fish meal and sold. Ecosystem indicators in the annual SAFE document suggest that the groundfish fisheries are not fishing down the food chain, that is, fishing out populations of larger predator species and moving down the chain to harvest smaller species that tend to serve as ecosystem prey and forage (Boldt 2005, pp. 258-259). This issue is discussed at greater length in Chapter 11 of this EIS, which deals with ecosystem relationships.

Discards of offal and processing wastes, and fish that escape from fishing gear, may provide an additional source of food for some seabird species. Evidence suggests that offal discards from fishing operations can have population level impacts on bird species (Furness 1999). This impact may be offset by potential mortality occurring when seabirds, attracted by the food source, fly into fishing vessels, or become attracted to and trapped by fishing gear. Seabird behavioral changes associated with access to offal as a food source are a cause for concern, even if offal availability does increase populations. Moreover, reductions in offal availability may have complex, and potentially undesirable, ecosystem impacts. Furness discusses the possibility that reductions in offal availability, "leading to large scavenging seabirds switching diet, may have a severe impact on other seabird populations" if the birds switching diets begin to predate on other seabird populations (Furness 1999, p. 485). Under Alternative 5, offal availability is eliminated. Die-offs may occur among some species, such as fulmars albatrosses and shearwaters, as populations adjust (S. Fitzgerald, pers. comm.). Takes of seabirds attracted by offal and taken by fishing gear or vessel strikes was discussed earlier in this chapter.

The impacts of changes in groundfish TACs on seabird forage availability are difficult to predict. In the absence of models relating TACs to fishing mortality, and mortality to changes in forage availability to seabirds, it is necessary to depend on a qualitative analysis.

As noted above, seabirds may not depend heavily on the species and size classes of fish harvested by the directed groundfish fisheries. Forage fish harvests are restricted by regulation, and are believed to be small with respect to biomass. There does not appear to be evidence that fishing operations are fishing down the food chain. Discards of offal and processing wastes may provide an additional food source for seabirds, but the benefits would be offset by potential mortality.

Eliminating fishing, under Alternative 5, would end incidental take of forage species. Potential impacts of groundfish mortality on seabird forage would also be eliminated, but it is difficult to say if this would increase or decrease available forage. Offal discards would be eliminated as a food source for seabirds attracted to fishing operations, particularly northern fulmars, albatrosses, shearwaters, and gulls.

Table 9-4 Impacts of the alternatives on seabird prey availability

	A1	A2	A3, A4, and A5
Northern fulmar	This harvest strategy would not increase fishery mortality over the status quo in the BSAI. GOA TACs will increase considerably under this alternative, but actual increases in fishing mortality are likely to be modest. Pacific cod TACs do not increase. Most of the increase is concentrated on flatfish and other fish species. Halibut PSC constraints and other considerations may make it hard to fully harvest these species. Pollock TACs increase by about 11 to 17%, however fishermen would be harvesting larger fish and there would be little overlap with age classes harvested by seabirds. Smelt bycatch from the pollock fishery might increase, but it would remain small compared to smelt populations (see Chapter 6)	Limited impact, since northern fulmars forage widely on species taken in limited amounts by groundfish fishery.	These strategies involve decreases in fishing mortality for many species. Alternative 5 eliminates all fishing mortality. The considerations under the Alternative 2 harvest strategies apply to these harvest strategies as well. In general, these strategies may have somewhat lesser impacts on seabirds than Alternative 2.
Short-tailed albatross		Limited impact, since short-tailed albatross forage widely on species taken in limited amounts by groundfish fishery.	
Spectacled and Steller's eiders		Limited impact, since there is little overlap between groundfish fisheries and foraging areas	
Albatrosses and shearwaters		Limited impact, since albatrosses and shearwaters forage widely on species taken in limited amounts by groundfish fishery.	
Piscivorous seabirds		In general, there is little impact of the groundfish fisheries on forage, either because the species forage widely on species taken in limited amounts by groundfish fisheries, or because of limited overlap between groundfish fisheries and foraging areas or size classes of fish used for forage. Cormorants and guillemots have less ability to forage widely, and may be susceptible to localized depletion of prey.	
All other seabirds		Limited impact, since birds tend to target size classes and species that are not the subject of groundfish fisheries.	

Benthic habitat

The fishery impacts on benthic habitat are described in the Essential Fish Habitat EIS (NMFS 2005b). Seabird utilization of benthic habitat is described in Section 3.7 and the impacts of groundfish fishing on seabirds foraging on benthic habitat are described in Section 4.9.7 of the PSEIS (NMFS 2004).

Several seabird species exploit food resources on the seabed. Spectacled eiders are bottom feeders, eating mollusks and crustaceans at depths to 70 m. Steller's eiders feed in shallow inshore waters on clams, polychaete worms, and amphipods. Marbled and Kittlitz's murrelets depend on species that themselves depend on benthic habitat for part of their life cycles (NMFS 2004, pp. 3.7-50, 52, 4.9-237). Cormorants and alcids have diverse diets that include small schooling fishes (capelin and sand lance), demersal fish species, and crustaceans. These birds are capable of diving 40 m to over 100 m deep and are thus able to reach the ocean floor in many areas. Some species, such as cormorants and guillemots, usually forage in coastal waters during the breeding season, but other species forage well away from land (NMFS 2004). Bottom trawl gear has the greatest potential to indirectly affect these diving seabirds via physical changes to benthic habitat, but pelagic trawls (to various extents), pot gear, and longline gear also contact the ocean floor. Gear that contacts the seabed can reduce habitat complexity and productivity (NMFS 2004, pp. 4.9-241-242, 248).

There appears to be little overlap between groundfish fishing activities and the range of some of these species. Observer data suggest that there is no overlap between groundfish operations and spectacled eider habitat, and that Steller's eider feeding areas tend to be in shallow waters inshore of the groundfish fisheries. Based on an analysis of the observer data, there is currently no overlap between spectacled eider critical habitat and the groundfish fishery under the baseline conditions (NMFS 2004b, p. 248). Since Steller's eiders forage almost exclusively in shallow waters inshore of the groundfish fisheries, their preferred winter habitats are not subject to groundfish fishing effort. During the breeding season, the overlap of bottom trawl fisheries and Steller's eider critical habitat is also very limited, involving only a few vessels in a limited area of Kuskokwim Bay. The impacts of this small bottom trawl fishery on Steller's eider critical habitat have not been investigated. The fishing effort appears to be limited and a large area of critical habitat is not fished. The small amount of fishing in this area is limited by logistical considerations and lack of interest by the fleet. During ESA Section 7 consultations with NOAA, USFWS concluded that the fisheries were not likely to adversely affect Steller's eider critical habitat or their food supply through bottom-contact fishing gear (USFWS 2003a; NMFS 2004, p. 4.9-248).

Similarly, the foraging grounds for Marbled and Kittlitz's murrelets also appear to lie inshore of groundfish fishing operations (NMFS 2004, p. 4.9-237). Some species in the alcid, gull, and cormorant do fish well away from the shore. However, none of the cormorants or alcids appear to have experienced consistent or widespread population declines (Dragoo et al. 2003), so there is no indication that the carrying capacity of the environment has been decreased through changes to benthic habitat or any other mechanism (NMFS 2004, 4.9-242).

Table 9-5 Impacts of the alternatives on benthic habitat used by seabirds

	A1	A2	A3	A4	A5
Northern fulmar	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders
Short-tailed albatross	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders
Spectacled and Steller's eiders	Because of the OY restriction in the BSAI, this alternative would have no greater impact than A2. Any impact would be limited.	Overlap between groundfish fishing operations and eider feeding habitat appears to be limited.	This alternative might reduce impacts from the status quo; however, given the limited overlap under the status quo, this alternative would not have much impact.	This alternative might reduce impacts from the status quo; however, given the limited overlap under the status quo, this alternative would not have much impact.	This alternative might reduce impacts from the status quo; however, given the limited overlap under the status quo, this alternative would not have much impact.
Albatrosses and shearwaters	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders
Piscivorous seabirds	No additional impact in the BSAI. There may be some additional impact in the GOA, although less than proportionately to the increase in TACs, since fishing mortality and activity will be constrained to a smaller proportional increase than the TACs.	Foraging grounds for marbled and Kittlitz's murrelets appear to lie inshore of groundfishing operations. While there is overlap between fishing areas and alcid, gull and cormorant foraging areas, none of these species appear to have experienced widespread or consistent population declines.	Impacts similar to or somewhat less than A2	Impacts similar to or somewhat less than A2	This alternative might reduce impacts from the status quo; however, given the limited overlap under the status quo, this alternative would not have much impact.
All other seabirds	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders	Not bottom feeders

9.3 Reasonably Foreseeable Future Actions that may Affect the Impact of Groundfish Fishing on Seabirds

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on seabirds. These actions are described in Chapter 3.

Ecosystem-sensitive management

Increased attention to ecosystem-sensitive management is likely to lead to more consideration for the impact of the groundfish fisheries on seabirds, and more efforts to ensure that the ecosystem structure that seabirds depend upon is maintained, including prey availability. New observer data recording techniques are likely to lead to better estimates of seabird trawl bycatch takes. Research into trawl cable and “third wire” interactions is likely to lead to an improved understanding of the mechanisms by which seabirds are taken when they interact with the cables. This understanding may lead to trawling methods that take fewer seabirds through this mechanism. These results are likely to reduce any adverse impacts of fishery specifications. The Council is considering a proposal to remove requirements for seabird protection measures from small hook-and-line vessels operating within specific State ’inside’ waters in areas where recent research indicates that hook-and-line operations attract relatively few seabirds.

Research into the importance of offal as a food source for seabirds is ongoing at the AFSC. Researchers are working to describe the volume and physical characteristics of offal production in the groundfisheries during the years from 2003 to 2005. Researchers hope to relate “patterns of provisioning by fisheries,” of “seabird distributions in space and time and seabird bioenergetic requirements.” Research results should become available within the next year (S. Fitzgerald, pers. comm.; Pacific Seabird Group 2006, p. 53).

Fisheries rationalization

Rationalization may lead to fewer operations on the water. Moreover, if appropriate monitoring and enforcement provisions are incorporated into the programs, they can lead to more effective control over fisheries bycatch. These results are likely to reduce any adverse impacts of fishery specifications. Rationalization programs are under consideration in several fisheries, including the rockfish trawl fishery in the GOA, the head and gut trawl fishery in the BSAI, and the Pacific cod fishery in the BSAI. A Pacific cod program is speculative at this time.

Traditional management tools

Future actions include ongoing annual groundfish fisheries. These would cause additional incidental takes of seabirds, additional harvest of prey species, and additional impacts on benthic habitat. All of these would have adverse impacts on seabirds. However, while the groundfish fisheries are believed to have adverse impacts on seabirds through these mechanisms, in general, takes are believed to be small compared to the populations of affected seabirds. Groundfish fishing impacts on forage availability are believed to relatively small, especially given the variety of species consumed by seabirds. Moreover, there appears to be relatively little overlap between groundfish fishing operations and the benthic habitat used by bottom feeding seabirds.

In 2007, the Council will be considering refinements to existing regulations that set forth seabird avoidance measures for the hook-and-line gear fisheries. These refinements are intended to better coordinate applicable avoidance measures to the distribution of short-tailed albatross.

Actions by other Federal, State, and International Agencies

The USFWS will continue its management of coastal seabirds. These measures include research into the natural history and population status of seabird populations, efforts to protect bird populations (for example, through invasive species management in the Alaska Maritime National Wildlife Refuge), and listing of threatened or endangered bird species under the Endangered Species Act and consultations on actions that may affect listed species. If the Kittlitz's murrelet is listed on the ESA threatened or endangered list by USFWS, NMFS will review activities managed in the areas where this species occurs to determine if Section 7 consultation is necessary. These ESA activities by the USFWS and NMFS will likely reduce any adverse impacts of fishery specifications.

Although the short-tailed albatross population is increasing, their numbers remain extremely low (approximately 2,000), and the population remains heavily dependent on the protection of breeding grounds concentrated at the volcanic Torishima Island, Japan. International efforts are underway by Japan, the U.S. and Canadian agencies to promote the growth of this species population. The population has been growing at near maximum biological potential. Active public-private research efforts are underway to investigate the incidence of takes by fishing gear and to develop methods for reducing these takes that are practicable for industry. These efforts have led to the development of methods for reducing longline bycatch; research is currently underway into methods to estimate and reduce trawl interactions.

Private actions

Private firms will conduct fishing operations under the authority of the TAC specifications. The impact of these actions is considered under traditional management tools. In recent years, longline effort in the EBS appears to have trended upwards. Fishing effort measured as numbers of hooks has consistently trended upwards since 1997. Until 2002, catch per unit of effort decreases appear to have more than offset the effort increases, since the bycatch rate was falling. The bycatch rate stopped decreasing in 2003 and rose slightly that year. If this trend persists through the forecast period, it may offset some part of any future potential gains from reductions in bird bycatch per unit of effort in the longline fishery. Subsistence and recreational hunting impose additional mortality on seabirds. The Alaska Migratory Bird Council has been monitoring subsistence harvests for 10 years. Survey results may be found at their website: http://alaska.fws.gov/ambcc/harvest.htm.

Subsistence takes appear to be on the order of about 32,000 seabirds annually. About 29 percent of these were auklets, about 23 percent were murres, and abut 19% were king eiders. Annual average egg harvests in the late 1990s appear to be on the order of about 100,000 eggs. About 38 percent of these were murre eggs, and about 52 percent were gull eggs. As noted in Chapter 11, increasing levels of human activity may increase the potential for the introduction of Norway rats to islands with seabird breeding colonies. These could deplete bird colonies. The Pollock Conservation Cooperative, and private companies, are cooperating with NMFS in research into ways to reduce mortality associated with trawl cables. The Washington Sea Grant program, and the World Wildlife Fund, have been active in outreach efforts with Russian fishermen in the North Pacific, encouraging the use of streamer lines and conducting education efforts on bycatch mitigation (K. Kuletz, pers. comm., July 2006).

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Chapter 10 Essential Fish Habitat Assessment

This chapter addresses the mandatory requirements for an essential fish habitat (EFH) assessment enumerated in the final rule (67 FR 2343, January 17, 2002) implementing the EFH provisions of the Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267). An EFH assessment is prepared for any federal action that may adversely affect EFH. The mandatory requirements for an EFH assessment are:

- a description of the action;
- an analysis of the potential adverse effects of the action on EFH and the managed species;
- the Federal agency's conclusions regarding the effects of the action on EFH; and
- proposed mitigation, if applicable.

An EFH Assessment is required when the action agency determines that the effects of the action on EFH may be adverse. Chapter 4 discusses the effects of the action on groundfish species through a range of alternatives, including the preferred alternative. Thus, the following EFH Assessment, including references to Chapter 4, discusses the may effect determination and incorporation of existing, recent, and precautionary measures that lessen the effects to EFH. Additionally, Chapters 5, 6, 7, 9, and 11 analyze the effects of the alternatives on the habitat of specific resource components.

An EFH assessment may incorporate by reference other relevant environmental assessment documents, such as a Biological Assessment, another NEPA document, or an EFH assessment prepared for a similar action.

Benthic habitat is the living and non-living bottom habitat between the shoreline and the 200 mile outer limit of the U.S. EEZ. Benthic habitat is used synonymously with EFH in this analysis because virtually all of the seafloor in the area of active groundfish fisheries off Alaska has been designated as EFH for at least one species. Therefore, in this analysis, EFH impacts are considered a proxy for overall habitat impacts. Additional discussions of the impacts of alternative harvest strategies on the habitat of specific resource components are contained in the chapters addressing those resource components.

EFH is defined in the Magnuson-Stevens Act as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition of EFH, the EFH regulations at 50 CFR 600.10 specify that "waters" include aquatic areas that are used by fish and their associated physical, chemical, and biological properties, and may include areas historically used by fish where appropriate; "substrate" includes sediments, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' entire life cycle.

The criterion for analyzing effects on habitat is derived from the requirement at 50 CFR 600.815(a)(2)(ii) that NMFS must determine whether fishing adversely affects EFH in a manner that is "more than minimal and not temporary" in nature. This standard determines whether Councils are required to act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable.

The final rule for EFH (67 FR 2343; January 17, 2002) does not define minimal and temporary, although the preamble to the rule states, "Temporary impacts are those that are limited in duration and that allow the particular environment to recover without measurable impact. Minimal impacts are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions" (67 FR 2354).

In 2005, NMFS and the Council completed the Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska (EFH EIS; NMFS 2005). The EFH EIS provided a thorough analysis of alternatives and environmental consequences for amending the Council's FMPs to include EFH information pursuant to Section 303(a)(7) of the Magnuson-Stevens Act and 50 CFR 600.815(a). Specifically, the EFH EIS examined three actions: (1) describing and identifying EFH for Council managed fisheries, (2) adopting an approach to identify HAPC within EFH, and (3) minimizing to the extent practicable the adverse effects of Council-managed fishing on EFH. The EFH EIS evaluates the long term effects of fishing on benthic habitat features, as well as the likely consequences of those habitat changes for each managed stock based on the best available scientific information.

In this analysis, the effects of fishing on EFH are analyzed for alternative harvest strategies, using the best available scientific information. Analysis included the review of the EFH Descriptions (EFH EIS Appendix D.3) and associated Habitat Assessment Reports (EFH EIS Appendix F) to conclude whether or not an adverse effect on EFH will occur. A complete evaluation of effects would require detailed information on the distribution and abundance of habitat types, the life history of living habitat, habitat recovery rates, and natural disturbance regimes. Although more habitat data become available from various research projects each fishing year, much is still unknown about EFH in the EEZ. Specific effects on EFH for alternative harvest strategies and their resulting TAC levels, and the magnitude of the differences between them, are hard to predict with current data.

10.1 Description of the Action

The actions considered in this EFH assessment are the EIS alternatives described in detail in Chapter 2. The important components of these alternatives for the EFH assessment are the gear used, the fishing effort, the location of the fishery, and the timing of the fishery. This information for the groundfish fisheries is presented in the EFH EIS, and is incorporated here by reference. Appendix B of the EFH EIS contains an evaluation of the potential adverse effects of fishing activities on EFH, including the effects of bottom trawl and pelagic trawl gear on seafloor habitats. Summaries and assessments of habitat information for BSAI and GOA groundfish, and all other managed species, are provided in Appendix F of the EFH EIS. The EFH EIS describes an overall fishery impact for each fishery based on the relative impacts of the gear used (which is related to physical and ecological effects), the type of habitat fished (which is related to recovery time), and the proportion of that bottom type utilized by the fishery. Under the harvest strategy alternatives, fishing effort would decrease or increase to the level necessary to harvest the TAC. However, the general location of the fisheries, the fishing seasons, and the gear used in the fisheries are not likely to change under the alternatives.

The EFH EIS evaluations indicate that the groundfish fisheries do not affect non-benthic EFH, so the focus of this assessment is on the EFH for benthic species. Managed species with EFH defined as benthic habitat include crab, scallops, and groundfish. The groundfish fisheries do not affect marine salmon EFH because the groundfish fisheries do not affect pelagic habitat.

10.2 Impacts of Alternatives on EFH

Fishing operations change the abundance or availability of certain habitat features (e.g., prey availability or the presence of living or non-living habitat structure) used by managed fish species to spawn, breed, feed, and grow to maturity. These changes can reduce or alter the abundance, distribution, or productivity of that species, which in turn can affect the species' ability to "support a sustainable fishery and the managed species' contribution to a healthy ecosystem" (50 CFR 600.10). The outcome of this chain of effects depends on characteristics of the fishing activities, the habitat, fish use of the habitat, and fish population dynamics. The duration and degree of fishing's effects on habitat features depend on the intensity of fishing, the distribution of fishing with different gears across habitats, and the sensitivity and recovery rates of habitat features.

The groundfish fisheries use the following gear types: bottom trawls, pelagic trawls, dredges, longlines, pots, and dinglebars. These gear types damage or capture benthic species and may cause habitat degradation, as described in Appendix B to the EFH EIS (NMFS 2005).

The Council and NMFS have developed substantial restrictions on fishing that minimize potential adverse effects on EFH. The entire eastern Gulf of Alaska, about 60,000 square nautical miles, is closed to bottom trawling in part to protect corals and other benthic habitats. In the Bering Sea, bottom trawl closures encompass about 30,000 square nautical miles to reduce bycatch and protect seafloor habitats. Measures to protect Steller sea lions also provide full or partial closures to fishing in about 58,000 square nautical miles of the Aleutian Islands and Gulf of Alaska. More recently, the Council and NMFS adopted a suite of new measures to reduce the effects of fishing on EFH in the Aleutian Islands and GOA, protecting nearly 300,000 square nautical miles of habitat. The largest of these areas, the Aleutian Islands Habitat Conservation Area, prohibits bottom trawling over 279,000 square nautical miles to protect corals and other sensitive habitat features. The Bowers Ridge Habitat Conservation Zone north of Adak is closed to all mobile bottom-contact gear. The Aleutian Islands Coral Habitat Protection Areas are closed to all bottom-contact fishing gear, protecting six especially sensitive "coral gardens." Ten areas known as the GOA Slope Habitat Conservation Areas along the continental slope are closed to bottom trawling to protect hard bottom that may be important to rockfish. Five small GOA Coral Habitat Protection Areas in southeast Alaska are closed to all bottom contact fishing to protect dense thickets of red tree corals. Another fifteen areas offshore called the Alaska Seamount Habitat Protection Areas are closed to all bottom fishing to protect seamounts.

Table 10-1 summarizes the impacts of groundfish fishing on EFH under the five alternatives. The impacts of each alternative re described in more detail in subsequent sections.

Table 10-1 Summary of Impacts on Essential Fish Habitat

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Magnitude of Impact	Minimal, more than status quo.	Minimal, same as analyzed in EFH EIS	Minimal, less than status quo	Minimal, less than status quo	none
Duration of Impact	persistent	Persistent, same as analyzed in EFH EIS	persistent	persistent	none

10.2.1 Alternative 2 Status Quo

Alternative 2 would implement a harvest strategy that would produce harvest levels that are similar to those evaluated in the EFH EIS and would likely have similar impacts on EFH. This alternative would not change the spatial distribution of the groundfish fisheries. However, the implementation of a wide variety of existing closed areas and gear restrictions would continue to restrict the spatial distribution of the groundfish fisheries and potential effects on EFH.

About 71 percent of the Alternative 2 TAC is pollock that would be taken with pelagic trawls. This gear has relatively small impacts on benthic habitat, although the EFH EIS notes that "pelagic trawls may be fished in contact with the seafloor, and there are times and places where there may be strong incentives to do so, for example, the EBS shelf during the summer" (NMFS 2005). Trawl performance standards for the directed pollock fishery at 50 CFR 679.7(a)(14) reduce the likelihood of pelagic trawl gear use on the bottom. However, in 2008 about 58 percent of the Alternative 2 TAC is estimated to be pollock. This decline in pollock harvests would be offset by increasing flatfish TACs. Since flatfish are harvested with bottom gear, the impacts to habitat may increase in 2008.

Concern exists about the contact of pelagic trawl gear on the bottom and the current standards used to limit bottom contact (from June 2006 minutes of the SSC and AP, available from http://www.fakr.noaa.gov/npfmc/minutes/minutes.htm). Debate is ongoing on whether the current standards need to be evaluated and whether the level of potential impact on the bottom from pelagic trawl gear is a concern. The description of impacts by pelagic trawl gear on habitat in this document is based on the best available science, but may be considered controversial with some believing the impact may be more than described. Research is ongoing at the AFSC to better understand the potential effects of pelagic trawl gear on benthic habitat.

The analyses in Section 4.3 and Appendix B of the EFH EIS indicate that groundfish fishing has long-term effects on benthic habitat features off Alaska and acknowledges that considerable scientific uncertainty remains regarding the consequences of such habitat changes for the sustained productivity of managed species (NMFS 2005). Nevertheless, the EFH EIS concludes that the effects on EFH are minimal, although some may be persistent, because the analysis finds no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term. Therefore, protection measures for the fisheries to reduce the adverse effects on EFH are not required by 50 CFR 600.815. Regardless, the Council recommended precautionary measures to provide protection to EFH and HAPCs from the effects of fishing activities. This action continues the Council's policy of implementing precautionary conservation measures for the Alaska fisheries, as described in the management policies and objectives added to the groundfish FMPs in 2004 (69 FR 31091; June 2, 2004).

Thus, NMFS concludes that Alternative 2 impacts EFH for managed species, but that the available information does not identify effects of fishing that are more than minimal. In other words, some adverse effects may occur but they would not exceed the minimal and temporary limits established by 50 CFR 600.815(a)(2). This conclusion is based on the analysis presented in the EFH EIS and the mitigation measures enacted under Amendments 78/65 and 73/65 to the BSAI and GOA groundfish FMPs, respectively, that established closed areas in sensitive habitat areas of the AI and GOA (71 FR 36694, June 28, 2006). Due to the nature of this action, the groundfish fisheries are not predicted to have additional impacts beyond those identified in the EFH EIS. No new information is available that would change these determinations in the EFH EIS.

10.2.2 Alternative 1

In the BSAI, the harvest strategy in Alternative 1 results in the same TACs levels as Alternative 2, therefore the effects on EFH in the BSAI would be the same.

Alternative 1 would allow for larger amounts of overall harvest in the GOA, which may result in levels of fishing effort above those seen under the current management regime and may cause mortality of benthic organisms beyond those currently experienced. For example, 2007 Alternative 1 GOA TACs are nearly double the Alternative 2 TACs. This increase in harvest may result in additional removal of organisms from the benthic community that may result in changes to the community structure, depending on the type of organisms removed and the potential rate of recovery. Information on how the additional harvest may change the community structure is not available at this time. The geographic management of the groundfish fishery would not change under Alternative 1.

Much of the Alternative 1 metric tonnage would consist of species taken with longline and non-pelagic trawl gear. These species include Pacific cod (44,000 mt), rex sole (44,000 mt), arrowtooth flounder (184,400 mt), and others. Longline gear and non-pelagic trawls work on the bottom and can have an adverse impact on benthic habitat (see the descriptions of effects of gear on benthic habitats in Section 3.4 of the EFH EIS).

Because of the increased TACs in the GOA, the impacts of Alternative 1 on EFH are considered potentially more adverse than for Alternative 2. However, increased TACs may not lead to proportionate increases in fishing activity or harvests, or benthic habitat impacts. It may not be possible to market the increased quantities of many of these species (for example, increased arrowtooth flounder TACs). In other instances, incidental catch constraints for PSC species, like halibut, may limit the industry’s ability to catch the increased TACs. Additionally, the EFH conservation measures, HAPC sites, and other area closures and gear restrictions established in the FMPs protect areas of ecological importance to the long-term sustainability of managed species from fishing impacts, regardless of the TAC levels.

10.2.3 Alternatives 3 and 4

Alternatives 3 and 4 would implement harvest strategies that produce TACs at levels that are below those evaluated in the EFH EIS and would likely have fewer impacts on EFH. Alternative 3 harvest strategy produces TACs in the BSAI and GOA that are 74 percent of the respective TACs produced under Alternative 2. Likewise, Alternative 4 harvest strategy produces a BSAI TAC that is 69 percent and a GOA TAC that is 63 percent of the respective TACs produced under Alternative 2. Alternatives 3 and 4 would not change the spatial distribution of the groundfish fisheries. However, the implementation of a wide variety of existing closed areas and gear restrictions would continue to restrict the spatial distribution of the groundfish fisheries and potential effects on EFH. Thus, NMFS concludes that Alternatives 3 and 4 would have lesser impact on EFH for managed species than Alternative 2. However, given that the effects of fishing under Alternative 2 are minimal, and given the existing EFH protection measures, it is not possible to quantify whether the reduction in fishing effort under Alternatives 3 and 4 would measurably improve EFH.

10.2.4 Alternative 5 No Action

Alternative 5 sets the TACs to zero. No groundfish fisheries would have an allocation, and therefore, no fishing would occur. A no fishing regime would result in no impacts on EFH because no additional mortality on living benthic habitat would occur. Abundance increases for short-lived biota with fast recovery rates may occur relatively quickly if no fishing occurred. For other species of living substrates, such as long-lived corals and perhaps some sponges that have been completely eradicated from some areas, increases may not occur or would occur very slowly. Even though the ability of the biota to recover from the impacts of the current fishing practices vary, the effects of Alternative 5 on EFH would be less than the current management and therefore eliminate the adverse impacts of ongoing groundfish fishing on EFH.

The elimination of fishing would allow for widespread protection of the geographic diversity of benthic communities. Some changes in community structure may be seen with no fishing, but detectable, meaningful changes in community structure are expected to take longer than two years to accrue. Shorter lived species that are capable of re-colonizing damaged areas may increase the structure in some benthic communities.

10.3 Reasonably Foreseeable Future Actions That May Affect the Impact of the Groundfish Fisheries on EFH

The following reasonably foreseeable future actions may have a continuing, additive and meaningful relationship to the effects of the alternatives on EFH. These actions are described in Chapter 3.

Ecosystem-sensitive management

Habitat is one component of the ecosystem in which the groundfish fisheries are prosecuted. Future fisheries management measures will be developed that consider the entire ecosystem, including habitat. Ongoing habitat research will increase our understanding of the spatial distribution of different habitats, the importance of different habitats to different life stages of fish species, the impact of different types of fishing gear on different types of living and nonliving habitat, and the recovery rates for different types of habitat. Ongoing research is summarized in the Ecosystems Considerations SAFE (Boldt 2005).

Moreover, increased protection for benthic habitat will be implemented to mitigate fishing impacts. The identification of EFH and implementation of EFH conservation measures and HAPC, along with any additional future habitat protection measures, are likely to result in decreased mortality and damage to marine habitat, an increase in benthic community structure, and changes in the distribution of fishing effort (NMFS 2005). The Council is considering alternatives for enhanced EFH mitigation in the Bering Sea. To the extent that the implementation of an ecosystem approach to management will likely result in reduced or modified fishing, the impacts of the proposed action will be reduced.

Fisheries rationalization

Many of the resulting changes to the prosecution of the fisheries under rationalization would potentially reduce impacts of the fisheries on EFH. Future rationalization of the groundfish fisheries is expected to reduce fishing effort and improve manageability of the fisheries through better harvest and bycatch controls. A rationalization program would reduce the number of vessels that participate in the groundfish fisheries. A rationalization program would also potentially reduce the effects of the fisheries on EFH by providing fishermen the time to improve fishing practices and avoid sensitive habitat areas. With a guaranteed share of the harvest, fishermen would have the time to be selective and choose where to fish to avoid fishing on grounds with crabs or other benthic species. Increases in monitoring and observer coverage from implementing a rationalization program would increase our understanding of the impacts of these fisheries on EFH by providing better bycatch information and fishery locations. To the extent that the implementation of fisheries rationalization will likely result in reduced effort or modified fishing, the impacts of the proposed action may be reduced.

Traditional management tools

Since portions of habitat are impacted each year by fishing activities and since some of those habitats may require exceptionally long periods to recover from fishing impacts (i.e., slow growing, long lived corals; NMFS 2005), the current harvest specifications, in combination with future harvest specifications, may have lasting effects on habitat. As the slow-growing, long-lived components of the habitat are impacted by cumulative years of fishing, there is likely to be cumulative mortality and damage to living habitat and changes to the benthic community structure. Species that are able to recover faster from fishing impacts may displace the longer-lived, slower-growing species, changing the structure and diversity of the benthic community. Improved monitoring and enforcement would improve the effectiveness of existing and future EFH conservation measures by ensuring the fleet complies with the protection measures, and thus, reduces the impacts of the future harvest specifications.

The EFH EIS noted that "…habitat loss due to fishing off Alaska is relatively small overall, with most of the available habitats unaffected by fishing…[b]ased on the best available scientific information, the EIS analysis concludes that despite persistent disturbance to certain habitats, the effects on EFH are minimal because the analysis finds no indication that continued fishing activities at the current rate and intensity would alter the capacity of EFH to support healthy populations of managed species over the long term" (NMFS 2005). Since past fishing activity has not resulted in impacts that are more than minimal, and future fishing activity is expected to be constrained by reasonably foreseeable future actions, the future effects of a continued fishery are predicted to continue to be minimal. The Council also has begun evaluation of the effects of fishing on the Bering Sea bottom habitat. The analysis will improve the information known about the effects of fishing and may result in changes in fishing activities to protect EFH in the Bering Sea, if such protection is deemed necessary.

Other Federal, State, and international agency actions

In the EIS prepared for upcoming sales in the Outer Continental Shelf Leasing Program, the Minerals Management Service has assessed the cumulative effects of such activities on fisheries and finds only small incremental increases in effects of development that are unlikely to significantly impact fisheries and EFH (Minerals Management Service 2003). Because the levels of harvest are similar to, or less than, current management levels, and the locations of fishing are not changed under the alternatives, the cumulative impacts on EFH are considered similar to those analyzed in the EIS.

New harbor developments contribute to, and are a result of, private actions described below, and may be associated with impacts to the coastal zone. New harbor developments by the U.S. Army Corps of

Engineers-Civil Works are reviewed by the NMFS for effects on habitat with recommendations made to limit impacts.

The State's management of the Alaska Water Quality Standards and accepting primacy for the National Pollution Discharge Elimination System (NPDES) program from EPA may be future actions that affect EFH. The proposed generalization of residue criteria and increased discretion in determining exceedences of the water quality standards may result in changes in the quality of water located in nearshore EFH areas. Federal oversight of the State's implementation of the NPDES program would be critical to ensure the discharge activities do not result in less compliance with the Clean Water Act than is experienced under Federal management. In either case, potential exists for a decrease in water quality in nearshore EFH locations if changes are made to the programs that allow more pollutants enter the marine environment. Changes in water quality are likely to be localized effects near areas of development and are not likely to result in widespread impacts on EFH.

Expansion of State groundfish fisheries would impact EFH in State waters. The effects of those impacts combined with the impacts of the proposed action and its alternatives would be offset by the probable reduction in fishing in Federal waters. The change would occur through future harvest specification processes. Thus, the effects of the annual harvest specifications in combination with the expansion of State groundfish fisheries would be similar.

Recently, the State of Alaska took emergency action to implement the EFH/HAPC measures and protect Aleutian Islands Coral Habitat Protection Areas. Additionally, in other areas where EFH conservation and protection measures overlap with State waters, the Council and NMFS recommend that the State Board of Fisheries (BOF) adopt parallel measures. The BOF will consider adopting counterpart regulations for state-permitted fisheries at its October 2006 meeting.

Private actions

Other factors that may impact marine benthic habitat include ongoing non-fishing commercial, recreational, and military vessel traffic in Alaskan waters, and population growth that may impact the coastal zone. Appendix G of the EFH EIS identifies 24 categories of upland, riverine, estuarine, and coastal/marine activities that may have adverse effects on EFH (NMFS 2005). Little is known about the impacts of the listed activities on EFH in the GOA and BSAI. However, Alaska's coasts are currently relatively lightly developed, compared to coastal regions elsewhere. Despite the likelihood of localized impacts, the overall impact of these activities on EFH during the period under consideration is expected to be modest.

Conclusions

The continuing fishing activity in the years 2008 to 2015 is potentially the most important source of additional annual adverse impacts on marine benthic habitat. The size of these impacts would depend on the size of the fisheries, the protection measures in place, and the recovery rates of the benthic habitat. However, a number of factors will tend to reduce the impacts of fishing activity on benthic habitat in the future. These include the trend towards ecosystems management and fisheries rationalization. Ecosystem-sensitive management will increase understanding of habitat and the impacts of fisheries on them, protection of EFH and HAPC, and institutionalization of ecosystems considerations into fisheries governance. Fisheries rationalization may lead to reduced habitat impacts to the extent that fewer operations remain in a fishery, and the remaining operations are better able to comply with habitat protection and bycatch reduction measures. With diligent oversight, the effects of actions of other Federal, State, and international agencies and private parties are likely to be less important when compared to the direct interaction of commercial fishing gear with the benthic habitat.

10.4 Essential Fish Habitat mitigation

Extensive measures to mitigate the effects of the groundfish fisheries on EFH have been implemented under status quo management and are discussed in detail in the EFH EIS. Additionally, the Council and NMFS recently enacted Amendments 78/65 and 73/65 to the BSAI and GOA groundfish FMPs, respectively, to established closed areas in sensitive habitat areas of the AI and GOA (71 FR 36694; June 28, 2006). Since any alternative would be adopted under existing management measures, NMFS does not see a need for additional mitigation for EFH in connection with the proposed alternatives.

10.5 References

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10.6 Preparer and Persons Consulted

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Chapter 11 Effects on the Ecosystem

11.1 Key Ecosystem Relationships

This chapter addresses systemic relationships between components of the ecosystem, examining predator/prey relationships, energy flow and balance, and biological diversity. The issues, impacts, important considerations for each, and impact indicators, are described below in Table 11-1.

Table 11-1 Indicators for fishery induced impacts on ecosystem attributes.

Issue	Impact	Considerations	Indicators
Predator-prey relationships	Pelagic forage availability	Fishery induced changes outside the natural level of abundance or variability for a prey species relative to predator demands.	• Population trends in pelagic forage biomass (quantitative – pollock, Atka mackerel, catch/bycatch trends of forage species, squid and herring)
	Spatial and temporal concentration of fishery impact on forage	Fishery concentration levels high enough to impair the long term viability of ecologically important, non-resource species such as marine mammals and birds.	• Degree of spatial/temporal concentration of fishery on pollock, Atka mackerel, herring, squid and forage species (qualitative)
	Removal of top predators	Catch levels high enough to cause the biomass of one or more top level predator species to fall below minimum biologically acceptable limits.	• Trophic level of the catch • Sensitive top predator bycatch levels (quantitative: sharks, birds; qualitative: pinnipeds) • Population status of top predator species (whales, pinnipeds, seabirds) relative to minimum biologically acceptable limits
	Introduction of nonnative species	Fishery vessel ballast water and hull fouling organism exchange levels high enough to cause viable introduction of one or more nonnative species, invasive species.	• Total catch levels

Issue	Impact	Considerations	Indicators
Energy flow and balance	Energy redirection	Long-term changes in system biomass, respiration, production or energy cycling that are outside the range of natural variability due to fishery discarding and offal production practices.	• Trends in discard and offal production levels (quantitative for discards) • Scavenger population trends relative to discard and offal production levels (qualitative) • Bottom gear effort (qualitative measure of unobserved gear mortality particularly on bottom organisms)
	Energy removal	Long-term changes in system-level biomass, respiration, production or energy cycling that are outside the range of natural variability due to fishery removals of energy.	• Trends in total retained catch levels (quantitative)
Diversity	Species diversity	Catch removals high enough to cause the biomass of one or more species (target, nontarget) to fall below or to be kept from recovering from levels below minimum biologically acceptable limits.	• Population levels of target, nontarget species relative to MSST or ESA listing thresholds, linked to fishing removals (qualitative) • Bycatch amounts of sensitive (low potential population turnover rates) species that lack population estimates (quantitative: sharks, birds, HAPC biota) • Number of ESA-listed marine species • Area closures
	Functional (trophic, structural habitat) diversity	Catch removals high enough to cause a change in functional diversity outside the range of natural variability observed for the system.	• Guild diversity or size diversity changes linked to fishing removals (qualitative) • Bottom gear effort (measure of benthic guild disturbance) • HAPC biota bycatch
	Genetic diversity	Catch removals high enough to cause a loss or change in one or more genetic components of a stock that would cause the stock biomass to fall below minimum biologically acceptable limits.	• Degree of fishing on spawning aggregations or larger fish (qualitative) • Older age group abundances of target groundfish stocks

Other elements of this EIS also deal with ecosystem issues, evaluating the impacts of the specifications alternatives on a wide range of ecosystem components (target and other fish species categories, seabirds, marine mammals, and habitat). This section looks at ecosystem issues from a somewhat different perspective. It is concerned with systemic ecosystem impacts, rather than the impacts on specific resource components.

More information on the BSAI and GOA ecosystems may be found in several NMFS and Council documents (all links tested in July 2006):

- Ecosystem characteristics of the BSAI and GOA have been described annually since 1995 in the "Ecosystem Considerations" section of the annual "Stock Assessment and Fishery Evaluation" (SAFE) reports. This is treated as Appendix C to this EIS (Boldt 2005, p. 102). The most recent

Ecosystems Considerations for 2006 chapter is online at http://access.afsc.noaa.gov/reem/ecoweb/index.cfm .

- An overview of North Pacific ecosystem issues was provided in Section 3.10 of the PSEIS, and an evaluation of the impacts of the preferred FMP alternative bookends was provided in Section 4.9.10 of the PSEIS (NMFS 2004). The PSEIS is online at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm .
- Web pages and documents relating to the Council's efforts to more fully integrate ecosystems considerations into management are on the Council's Ecosystems Management web page: http://www.fakr.noaa.gov/npfmc/current_issues/ecosystem/Ecosystem.htm .
- The Center for Biological Diversity published "The Bering Sea. A biodiversity assessment of vertebrate species," in July 2006. It is a review of information regarding status of and potential threats on vertebrate species (mammals, birds, and fish) in the Bering Sea. This is available at the Center's web page: http://www.biologicaldiversity.org/swcbd/PROGRAMS/marine/bering/assessment.html

11.2 Impacts of alternative harvest strategies on ecosystem relationships

Predator-prey relationships

Predator-prey relationships are evaluated with respect to four indicators: (1) pelagic forage availability, (2) spatial and temporal concentration of fishery impact on forage, (3) removal of top level predators, and (4) introduction of non-native species.

Pelagic forage availability As noted in Table 11-1, the impacts on pelagic forage availability are assessed with respect to whether fishery induced changes are outside the natural level of abundance or variability for a prey species relative to predator demands. Impacts are assessed by examining biomass of GOA and BSAI walleye pollock, Aleutian Islands Atka mackerel, FMP forage species, squid, and herring.

The PSEIS evaluated the preferred alternative through the use of two "book-end" examples. One of these was more, and the other was less, conservation oriented. Pelagic forage availability results for each were similar. Under the less conservation oriented bookend:

> "…the estimated pelagic forage biomass for the age-modeled populations declines from the baseline in the BSAI and increases over the baseline in the GOA [over the period from 2003 to 2008]. Twenty-year biomass projections show similar trends. Average biomass, however, remains within the bounds of estimated biomass that occurred historically before a target fishery emerged. Bycatch of other forage species increases in the BSAI and declines in the GOA. Estimates of forage biomass from food web models of the EBS indicate that this level of bycatch is probably a small proportion of the total forage biomass…although because population-level assessments are lacking for some members of the forage species group, corresponding biomass estimates for these species are not available…average biomass projections for the age-modeled forage species remain within the estimated historical boundaries, and bycatch-based estimates for other forage species are small in relation to total forage biomass." (NMFS 2004, p. 4.9-352).

GOA walleye pollock population status and trends. The Ecosystems Considerations chapter (Boldt 2005, p. 36) notes that the estimated 2005 spawning biomass of GOA walleye pollock was 211,660 t, or 37 percent of the unfished biomass and below $B_{40\%}$ (229,000 t). The 1999 and 2000 year class strengths are above average and strongly influence estimates of spawning biomass. The estimates of the 2004 stock were larger than previous years due to the increasing contribution of the 1999 and 2000 year classes to the adult biomass. The impact of fishing on target species was evaluated in Chapter 4 of this EIS. The chapter found that GOA pollock was not overfished, not being overfished, and not approaching an overfished condition under the status quo, and that these conditions were not expected to happen under the other alternatives (Section 4.1, this EIS) Declining 2007 and 2008 ABCs are associated with spawning stock biomass declines.

Dorn et al. (2005) noted the decline in assessed adult pollock biomass in the GOA since the 1990 may have resulted in the observed declines of biomass or body weight of groundfish predators specializing in feeding on large pollock; specifically Pacific halibut and Pacific cod. Food habits studies (e.g. Yang and Nelson 2000) indicate that consumption rates of large pollock by cod and halibut have dropped between 1990 and 2005. On the other hand, consumption of juvenile pollock by arrowtooth flounder has remained high, suggesting that top-down control of juvenile pollock by arrowtooth (e.g. as described in Bailey 2000) may be limiting the availability of pollock to halibut and cod. While multispecies analysis was not performed specific to listed EIS Alternatives, the sensitivity analysis described in Dorn et al. (2005) suggested that current fishing levels may be a secondary factor behind arrowtooth predation in limiting pollock availability to other predators.

Aleutian Islands Atka mackerel population status and trends. The Ecosystems Considerations chapter (Boldt 2005) reports that total biomass of Atka mackerel was high in the early 1980s and again in the early 1990s and further increased from 2000 to 2004. Age-3+ Atka mackerel biomass was estimated for 2005 at 485,700 mt, approximately 14 percent less than the 2003 estimate. Female spawning biomass was projected to be above $B_{40\%}$, but is expected to drop below in 2007 to 2010. Atka mackerel are not considered overfished nor approaching an overfished condition. The 1999 and 2000 year classes were expected to be strong (Boldt 2005, p. 36). The impact of fishing on target species was evaluated in Chapter 4 of this EIS. The chapter found that AI Atka mackerel was not overfished, not being overfished, and not approaching an overfished condition under the status quo, and that these conditions were not expected to happen under the other alternatives (Section 4.1, this EIS) Declining 2007 and 2008 ABCs are associated with spawning stock biomass declines.

BS walleye pollock population status and trends. The Ecosystems Considerations chapter (Boldt 2005) notes that bottom trawl and echo integration trawl (EIT) survey biomass estimates for 2004 were 54 percent and 8 percent lower than estimates in the previous years surveyed (2003 for bottom trawl surveys and 2002 for the EIT survey). Peak exploitable biomass occurred in 1985 then declined until 1991. Exploitable biomass of age-3+ EBS pollock has been increasing since 1991 and has varied at around 10-11 million tons. The strong 2000 year class remains at high levels; however, estimates indicate the stock will drop below $B_{40\%}$ by 2006. The 2005 stock size is estimated to be at the lowest level since 1992 (Boldt 2005, p. 36). The impact of fishing on target species was evaluated in Chapter 4 of this EIS. The chapter found that EBS pollock was not overfished, not being overfished, and not approaching an overfished condition under the status quo, and that these conditions were not expected to happen under the other alternatives (Section 4.1, this EIS) Declining 2007 and 2008 ABCs are associated with spawning stock biomass declines.

Herring. The Ecosystems Considerations chapter (Boldt 2005) reported that bycatch in the BSAI groundfish fisheries (130.5 to 1723.3 mt) is typically higher than in the GOA groundfish fisheries (2.2 to 283.8 mt). Herring bycatch increased in 2003 and 2004 in the BSAI and in 2004 in the GOA in federally managed FMP groundfish fisheries. In 2004, herring bycatch was the third highest in the BSAI time series, and the highest on record in the GOA. The reason for this large increase in bycatch could be due to a shift in groundfish fisheries distribution, fishing techniques, and/or increased herring biomass. Both Kuskokwim and Norton Sound herring biomass estimates increased in 2003 and 2004.

The Ecosystems Considerations chapter goes on to report that the 2003 and 2004 BSAI herring bycatch estimates represent 0.52 percent and 0.55 percent of the total estimated herring biomass in four managed areas of the Bering Sea: Togiak, Norton Sound, Cape Romanzof district, and the Kuskokwim area, slightly above the 1994-2002 average (0.44 percent). Bycatch of herring relative to assessed populations in the GOA range from 1 percent to 5.3 percent of the Prince William Sound and southeast Alaska herring biomass estimates. The report summarizes that overall bycatch relative to the assessed population biomass is small, but that the extent of spatial overlap of the groundfish fisheries with these populations has not been examined (Boldt 2005, p. 36).

Herring are a prohibited species, and the impacts of groundfish fishing on herring were evaluated in Chapter 7 of this EIS. The analysis indicated that incidental mortality of herring was low in the groundfish fisheries, that the low mortality meant it was unlikely the groundfish fisheries were having an impact on the genetic structure of herring, that groundfish fishing and herring reproduction were separated spatially so that groundfish fishing was unlikely to affect reproductive success, and that groundfish fishing was unlikely to affect herring prey, or spawning habitat (Section 7.2, this EIS).

Squid. The Ecosystems Considerations chapter (Boldt 2005) attributed most squid catch as incidental to the pollock fisheries. Squid bycatch in groundfish fisheries of the GOA decreased from 1997 to 2000 (97.5 to 18.6 t) and then increased in 2001 (90.8 t) due to very high catches in Area 620 and increased catches in Areas 610 and 630. The estimates for GOA squid bycatch were last updated in 2003. Bycatch of squid in the BSAI decreased from a high of 9000 t in 1978 to low levels (100s of tons) from 1987 to 1995. Squid bycatch in the BS increased in 2001 to 1,766 t and 2002 to 1,344 t due to high catches in Areas 517 and 519 (Boldt 2005, p. 37).

There are no reliable biomass estimates for squid. In the BSAI it is managed as a Tier 6 species, with an ABC equal to the average catch from 1978 to 1995. Squid bycatches are believed to be small relative to other predation on squids (NPFMC 2005, pp. 859, 867). In the GOA, squid are included as one of the species in the "other species" category.

During the summer of 2006, squid bycatch was unexpectedly high. The total incidental catch of squid through July 15 was 1,403 mt. Total catch was 110 percent of the TAC, 71 percent of the ABC, and 54 percent of the OFL. Participants in the shoreside pollock fishery entered into an agreement to not fish a high bycatch area called the "squid triangle." As of July 24, the fleet had agreed to remain out of the area for an undetermined amount of time. The weekly rate of bycatch for the week of July 15 was estimated at 74 mt compared to 550 mt for the week of July 8. As of July 24, the expectation was that if recent years' squid catch patterns by area and month remained constant in 2006, cessation of fishing by the shoreside pollock fleet in the squid triangle may limit catch enough to avoid additional fishery restrictions by NMFS (NMFS 2006).

Forage species. The Ecosystems Considerations chapter (Boldt 2005) notes that the bycatch of forage species in the GOA increased considerably in 2001 (540.8 t) compared to 1997 through 2000 (27.2-124.9 t), primarily due to a large increase in the catches of smelts in Area 620 (128.8 t). Forage fish bycatch decreased to 158.3 t in 2002. In 2001, bycatch of pricklebacks (Family Stichaeidae) was also higher than in previous years (4.66 t compared to 0.03 -3.53 t) due to catches in Areas 610, 620, and 630. Prickleback bycatch was reported to have decreased to 0.1 t in 2002.

The same report estimated the biomass of smelts, capelin and eulachon in the GOA at a low of 7,535 t in 1984 and a high of 116,080 t in 2003. GOA exploitation rates of eulachon and capelin were 0.2 percent

(1999), 1.0 percent (2001), and 0.2 percent (2003) for both species combined. Record high catches of Pacific sandfish were caught in the Eastern GOA in 2003 (Boldt 2005).

Bycatch of forage species has been variable in the BSAI with catches of sandfish observed in 2000 in Area 513. Bycatch of sand lance and lanternfish also increased in 2001. There is no population abundance assessment of BS forage fish; therefore, bycatch can not be compared to estimated biomass (Boldt 2005, p. 37).

Impacts on forage fish were analyzed in Chapter 6 of this EIS. Most forage fish bycatch is smelts, taken with pelagic trawl gear being used to harvest pollock. The analysis found that mortality was small relative to biomass, and in general, impacts on smelt genetics, reproductive success, prey, and habitat were likely to be small (Section 6.2, this EIS).

The considerations above characterize the status quo. The impacts of the other alternative harvest strategies are evaluated in comparison to the status quo Alternative 2. Alternative 1 is equivalent to Alternative 2 in the BSAI, and is associated with higher TACs in the GOA. These higher TACs would fall within GOA ABCs. Moreover, in many instances fishermen may not be able to increase harvests of flatfish species, where those harvests are already constrained by halibut PSC. Alternatives 3, 4, and 5 have lower, or zero, TACs, and would remove less pelagic forage from the ecosystem.

Spatial and temporal The spatial and temporal concentration of the fishery and its effects on forage fish criterion and its indicator are described in Table 11-1. The spatial and temporal concentration of fishery impacts on forage species is assessed with respect to whether or not fishery concentration levels are high enough to impair the long term viability of ecologically important, non-resource species such as marine mammals and birds. The indicator is the degree of spatial/temporal concentration of the groundfish fisheries on pollock, Atka mackerel, herring, squid, and forage species. This is evaluated qualitatively by considering the potential for the alternative to concentrate fishing on forage species in regions used by predators tied to land, such as pinnipeds and breeding seabirds (NMFS 2004, p. 353).

Groundfish fishing impacts on marine mammals, seabirds, forage species (the dominant forage species harvest is smelts), and prohibited species (which includes herring) were discussed in detail in earlier chapters of this EIS.

All alternatives under consideration would continue the existing closures around Steller sea lion rookeries, trawl and fixed gear closures in nearshore and critical habitat areas, the ban on directed fishing for forage fish, the seabird protection measures required since February 2004 in hook-and-line fisheries, and the spatial/temporal allocation of TAC for some of the BSAI and GOA pollock and Atka mackerel fisheries. The Ecosystems Consideration chapter of the SAFE (Boldt 2005) provides a map of groundfish closures in Alaska's EEZ and a table summarizing groundfish trawl closures implemented since 1995.

BSAI pollock fisheries have increased catch in northern fur seal foraging habitat, but more research is required to evaluate whether the amounts of pollock removed are having a population-level effect on fur seals. The relationship between the pollock fishery and fur seals is described at greater length in Chapter 8 of this EIS and in the recently completed EIS on the Pribilof Islands fur seal subsistence harvests (NMFS 2005b).

Alternative 1 involves larger TACs than the status quo (Alternative 2) in the GOA, but not in the BSAI. The TAC increase in the GOA is primarily flatfish and this increase is unlikely to be fully harvested because of halibut PSC constraints. There is an increase in GOA pollock harvest, and this may also be associated with some increase in smelt bycatch. Alternatives 3, 4, and 5 have lower TACs than the status quo alternative, and would be associated with smaller removals of fish used as forage.

Removal of top predators The evaluation criterion for removal of top level predators is whether catch levels are high enough to cause the biomass of one or more top level predator species to fall below minimum biologically acceptable limits. Removal of top predators, either through directed fishing or bycatch, is assessed by (1) an examination of the trophic level of the catch or bycatch, (2) the bycatch levels of sensitive top level predators, and (3) the population status of top predator species relative to acceptable limits (See Table 11-1).

The PSEIS points out that the trophic level of the catch in both the BSAI and GOA has been stable. (NMFS 2004, p. 353). The PSEIS pointed to research that found no evidence that groundfish fisheries had caused declines in trophic guild diversity for the groups studied. Observed changes in trophic guild diversity appeared to be related primarily to recruitment rather than to fishing (NMFS 2004, p. 3.10-26). More recently, as noted in the 2006 Ecosystems Consideration chapter of the SAFE (Boldt 2005), it was reported that stability in the trophic level of the total fish and invertebrate catches in the EBS, AI, and GOA are another indication that the “fishing-down” effect is not occurring in these regions. Despite the general increase in the catch since the late 1960s in all areas, the trophic level of the catch has been high and stable over the last 25 years.

Boldt (2005, p. 267) also reports on a Fishery in Balance (FIB) Index which declines when catches do not increase as expected when moving down the food web, relative to an initial baseline year. In the Alaska Region, the index suggests that catches and trophic level of the catch in the EBS, AI, and GOA have been relatively constant and suggest an ecological balance in the catch patterns. Figure 11-1 shows trends in key indices of the trophic level of catches in the GOA, EBS, and AI, over the period from the early 1950s to 2002.

Alternative 2 is the status quo alternative. The other alternatives are evaluated qualitatively in comparison with Alternative 2. Alternative 1 would involve larger harvests of some groundfish species in the GOA, but not the BSAI. All harvest levels would be within the ABC, and the regional OY limit. Moreover, increases in flatfish harvests would likely be constrained by halibut PSC limits. Alternatives 3, 4, and 5 would be associated with smaller removals of groundfish from the ecosystem (removals would be zero under Alternative 5). Ecosystem responses to changes under these alternatives could be complex. Because there is little evidence of fishing down the food web under the status quo, reducing groundfish harvests is not expected to have much effect on this indicator.

Lower trophic levels are more biologically productive; therefore, catch should increase as a fishery exploits lower trophic levels. The FIB index is designed to reflect the balance of the trophic level of harvest and the size of the harvest. If trophic levels are declining, the index will decline, unless fishery harvest increases enough to offset the declining trophic level. Large enough productivity increases could even lead to an increase in the value of the index for a declining average trophic level of catch. In general, and particularly in recent years, average annual trophic levels for retained catch in Alaska groundfish fisheries have not varied very much. Increased catch of GOA Pacific ocean perch, a lower trophic-level-fish, in the 1960s resulted in a slight decrease in the overall trophic level of the catch during that time period. Increasing catches and roughly stable trophic levels led to increasing FIB index values over the period from the mid-1950s to the 1970s in the EBS, and the 1980s in the AI and GOA. In the GOA, increased total catches and decreased POP catches in the 1970s also contributed to this trend in the FIB index. Since the early 1990s, FIB levels have been fairly stable in the EBS and AI, and have shown more variation in the GOA. The Ecological Considerations chapter of the SAFE report (Boldt 2005) interprets the results as suggesting an ecological balance in catch patterns.

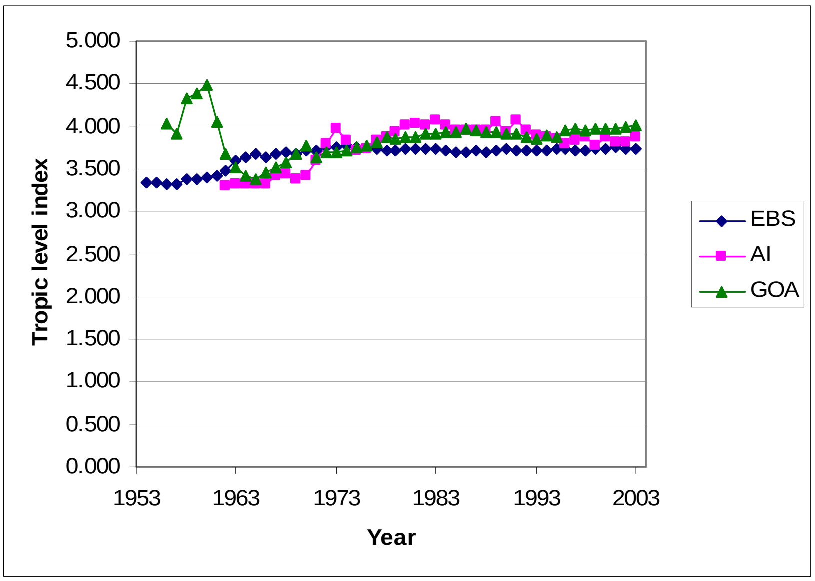
The equation for the FIB index is:

$$\text{FIB}= \log\left(Y_i \times \left(\frac{1}{TE}\right)^{TrL_i}\right) - \log\left(Y_0 \times \left(\frac{1}{TE}\right)^{Trl_0}\right)$$

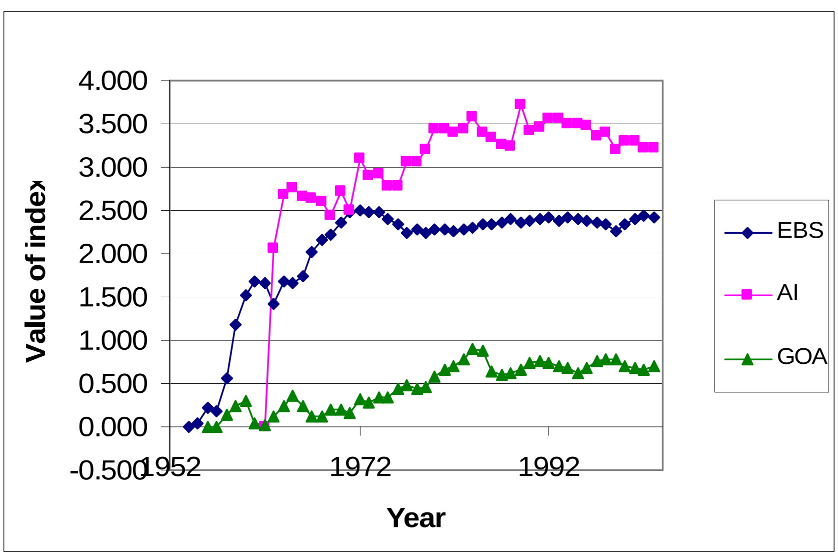
Y=landings
TE=trophic efficiency=fraction of production passing from one trophic level to the next=0.1
TrL=trophic level of catch

The equation is the difference in one year (subscript i) compared to the baseline year (subscript 0).

Figure 11-1 Indices of Trophic level of catches in the GOA, EBS, and AI



Trophic level of catch: Species in different trophic levels are assigned a numerical index between 1 and 5. Trophic levels are assigned based on diet composition data for the species. The index is a weighted average of the species trophic levels, with the weights given by the volumes of the species in landings.



Pauly's Fishery in Balance (FIB) index of trophic level of catch (Pauley et al. 2000). Fishing down the food web might be a deliberate policy, since fishing species at a lower trophic level might be a strategy for reducing lost system energy. The FIB takes account of this, and only declines if reductions in trophic level are not offset by appropriate increases in productivity. Increases reflect increases in catch and trophic level and new stocks exploited.

Source: AFSC website http://intra.afsc.noaa.gov/reem/ecoweb/EcoChaptDataFrame.cfm (July 31, 2005).

Chapter 8 of the EIS examined the impacts of the alternative groundfish fishery harvest strategies on incidental takes, as well as prey competition and disturbance of marine mammals. Chapter 8 also provides an appraisal of marine mammal takes with respect to PBR. The PBR is the maximum number of animals that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. Chapter 9 examined the impacts of alternative harvest strategies on incidental takes, as will as prey competition, and benthic habitat disturbance of seabirds.

The effect of shark bycatch on shark populations is a concern because these are late maturing, low fecundity, low natural mortality species. A special analysis of sharks was included in the 2004 SAFE reports and reported that “Preliminary comparisons of incidental catch estimates with available biomass estimates suggest that current levels of incidental catches are low relative to available biomass for spiny dogfish and Pacific sleeper sharks in the GOA and for Pacific sleeper sharks in the BSAI.” Other shark species (salmon shark, spiny dogfish in the BSAI, and other species) were reportedly rarely captured (NPFMC 2004, p. 1010).

In 2005, the Council amended its GOA FMP Amendment 69 to provide more controls over the “other species” TAC that limits potential shark harvest. In 2004, the AFSC included an appendix on sharks in the BSAI and GOA as part of the BSAI SAFE reports. In 2005, the SAFE included a separate chapter for BSAI sharks. In 2006, the AFSC is preparing separate shark chapters for both the BSAI and GOA. The Council’s non-target species committee is reviewing the potential for separate shark OFLs, ABCs, and TACs in the BSAI and GOA.

Alternative 1 is associated with higher TACs than the status quo harvest strategy in the GOA (but, as noted elsewhere, not necessarily larger catches for many species). This may have a more adverse impact through impacts on trophic level of catch, sensitive top predator bycatch, and on the population status of top predators. Alternatives 3 and 4 may have smaller impacts than Alternative 2. There is no harvest allowed under Alternative 5, and therefore, no impacts on these indicators.

Introduction of non-native species The introduction of non-native species through ballast water exchange and hull-fouling organism release from fishing vessels could potentially disrupt the Alaskan marine food web structure. There have been 24 non-indigenous plant and animal species documented in Alaskan marine waters, primarily in shallow-water nearshore and estuarine ecosystems, with 15 of those species recorded in Prince William Sound. It is possible that most of these introductions were from tankers or other large commercial vessels that have large volumes of ballast exchange. However, exchanges via fishery vessels that take on ballast from areas where invasive species have already been established and that then transit through Alaskan inshore waters has been identified as a threat in a recently developed State of Alaska Aquatic Nuisance Species Management Plan (NMFS 2004, p. 4.9-354)

An important invasive species concern is the potential introduction of Norway rats by fishing vessels onto islands with colonies of seabirds that may be vulnerable to rat predation. Visits by fishing vessels to islands with ports, moorage near shore in protected waters, or shipwrecks, could lead to the introduction of rats. Burrowing or cliff dwelling seabirds may be particularly vulnerable to rat predation. Populations in vulnerable colonies could be reduced, or possibly destroyed.

Total groundfish catch levels are used as an indicator of potential changes in the risk of invasive species introductions by groundfish fishery vessels. Larger catch levels are associated with increased vessel activity, more exchanges of ballast water, and more visits to islands with vulnerable bird colonies. TACs in the GOA (but not in the BSAI) increase substantially beyond the Alternative 2 status quo harvest strategy under Alternative 1. This alternative may be associated with more vessel activity. However, in several important instances, fishermen may not be able to catch more GOA flatfish under Alternative 1 than under Alternative 2, because harvests are already constrained by halibut PSC. Catch levels are less than the status quo alternative under Alternatives 3, and 4. Catch levels are set to zero under Alternative 5.

Rationalization programs in fisheries may reduce the potential impacts of the alternatives. The pollock AFA program, and the crab rationalization program have reduced the numbers of separate pollock and crab vessels used to take any given level of TACs in these fisheries. Programs such as these may reduce the potential for introduction of invasive species. The Council has adopted a cooperative rationalization program for head-and-gut groundfish trawl vessels in the BSAI, and a two year Rockfish Demonstration Project in the GOA. Other programs are under consideration.

Energy flow and removal

The impacts on the movement of energy through the ecosystem are evaluated with respect to two indicators: (1) removal of energy from the system through fishing operations, and (2) the redirection of energy flow into new pathways by fishing operations.

Energy removal Fishing may alter the amount of energy in an ecosystem by removing energy through the retained harvest of fish. The indicator for energy removal is trends in total retained catch levels (Table 11-1). The PSEIS notes that "the annual total catch biomass in the EBS is estimated at about one percent of the total system biomass, excluding dead organic material. There is no indication that the annual removal of this small biomass percentage alters the amount and flow of energy sufficiently to affect ecosystem stability" (NMFS 2004, p. 24).

Total retained catch mortality under the status quo alternative, Alternative 2, is expected to be similar to that observed in recent years. Alternative 1 will increase expected total retained catch mortality in the GOA, but not in the BSAI (although actual mortality is likely to be less than potentially allowed by the TACs, because of the difficulty of finding markets in some cases, and because of halibut PSC constraints in others). Alternatives 3 and 4 are associated with reduced biomass removals. Alternative 5 sets all TACs equal to zero and would be associated with no biomass removals. Biomass removals under the status quo are a relatively small proportion of system biomass. The reductions under Alternatives 3, 4, and 5 are not expected to have a large impact on this indicator.

Energy re-direction Fishing may alter the direction of energy flow in an ecosystem. Energy re-direction, in the form of discards, fishery offal production, or unobserved gear-related mortality, can change the natural pathways of energy flow in the ecosystem. The recipients, locations, and forms of this returned biomass may differ from those in an unfished system. Three factors, (1) trends in discard and offal production, (2) scavenger population trends, and (3) bottom gear effort, were identified as formal indicators of energy redirection in Table 11-1. Animals damaged when passing through the meshes of trawls may later die and be consumed by scavengers. Bottom trawls can expose benthic organisms and make them more vulnerable to predation. Discards and offal production can cause local enrichment and changes in species composition or water quality if discards or offal returns are concentrated in confined areas such as estuaries, bays, and lagoons (NMFS 2004, p. 355).

Ecosystem Considerations (Boldt 2005, p. 257) shows that biomass discards in BSAI and GOA groundfish fisheries dropped substantially in 1998 with the introduction of regulations prohibiting the discards of pollock and Pacific cod. The BSAI biomass discard rate in 2004 was about 6 percent, while the GOA rate was under 10 percent. The PSEIS (NMFS 2004, p. 25) summarizes a 1995 report that states the total production of discarded fish and processing wastes in the BSAI and GOA ecosystems were about one percent of the unused detritus already going to the bottom. With the new retention requirements now in effect, this estimate would be substantially smaller. These authors found no changes in scavenger populations relating to changes in discard or offal production, and found the annual consumptive capacity of scavenging birds, groundfish, and crabs in the EBS to be over 10 times larger than the total production of discards and offal in the BSAI and GOA. Pathways of energy flow within the BSAI and GOA ecosystems, therefore, are apparently not redirected in any significant way by discarded fish bycatch and processing wastes that are returned to the sea.

Bottom gear effort may affect benthic habitat, and its capacity to support marine fish and invertebrates that use the habitat for protection from predators. Because of this, the use of bottom gear may be an indicator of the potential for this source of energy redirection. The PSEIS notes that present-day trends in bottom gear effort show there has been a decline in this effort over the last ten or more years (NMFS 2004, p. 25).

The Ecosystems Considerations chapter of the SAFE (Boldt 2005) discusses population levels for seven categories of scavengers: (1) birds, (2) gulls, (3) kittiwakes, (4) fulmars, (5) skates, (6) sablefish, and (7) Pacific cod. The groundfish fishery impacts on the bird species were discussed in Chapter 9, and the impacts of groundfish fishing on skates, sablefish, and Pacific cod were addressed under the first section of the target and other species chapter (Section 4.1).

This discussion suggests that groundfish impacts on scavenger populations are relatively limited under the status quo. Alternative 1 would increase harvests and associated offal and discards in the GOA, but not the Bering Sea. Since much of the additional TAC under this alternative is flatfish, it could lead to an increase in the use of bottom trawl gear. However, this activity is likely to be constrained below the TACs by the halibut PSC limits that constrain it now. Alternatives 3 and 4 would reduce production, and presumably offal and discard production, and Alternative 5 would eliminate it.

NMFS has adopted a final rule to implement Council BSAI FMP Amendment 79 that authorized a groundfish retention standard program in the BSAI for trawl catcher/processors 125 feet and longer that are not listed under the AFA. The action is intended to reduce bycatch and improve utilization of groundfish harvested by these non-AFA trawl CPs. The effective date is January 20, 2008 (71 FR 17362).

Diversity

Diversity is evaluated with respect to (1) species diversity, (2) functional diversity (or the diversity of components playing different roles in the ecosystem) and (3) genetic diversity.

Species diversity Species diversity is defined as the number of different species in an ecosystem. It can be altered if fishing results in removal of one or more species from the system. An impact on species diversity can be important if catch removals are high enough to cause the biomass of one or more species (target or nontarget) to fall below, or to be kept from recovering from levels below, minimum biologically acceptable limits.

Two different indices from the Ecosystem Considerations SAFE (Boldt 2005) were used to measure trends in species diversity. The index of species richness is the average number of fish taxa per haul in bottom trawl surveys. Estimated values for this index are shown below. Note that this index may be strongly affected by changes in the distribution of species; if some species are highly concentrated at the time the surveys are completed, the index would tend to have a lower value. The species richness index is shown in Figure 11-2 below.

The second index used to measure trends in species diversity is the Shannon-Weiner index. The formula for the Shannon-Weiner index is:

$$H = \sum_i p_i * \ln(p_i)$$

Where p is the proportion of the individuals in the trawl sample of a given species. The Shannon-Weiner index measures the number of species and the relative equality of the counts of the different species in the sample. This index takes a maximum value when equal numbers of species are present (the maximum value is equal to the log of the number of species present). The values for the Shannon-Weiner index are shown in Figure 11-3 below.

The values for the richness and diversity indices in the GOA increased from 1990 to 1999, peaked in 1999, and sharply decreased after 1999. In the BSAI, these indices underwent significant variations from 1982 to 2004; species diversity increased from 1983 through the early 1990s, was relatively high and variable throughout the 1990s, decreased significantly after 2001, and increased again to its long term average in 2004. Shifts in the locations of species included in the richness index appear to be the key determinants of changes in the richness index (Mueter 2005, p. 246).

Trends in the Shannon-Weiner index differ in the GOA and BSAI. While both indices track together in the GOA, they move in different directions in the BSAI.

> …low species diversity in the EBS in 2003 occurred in spite of high average richness, primarily because of the high dominance of walleye pollock, which increased from an average of 18 percent of the catch per haul in 1995-1998 to 30 percent in 2003, but decreased again to an average of 21 percent in 2004. (Mueter 2005, p. 246).

Without additional information, these indices may be of limited usefulness in evaluating diversity status. Mueter notes that

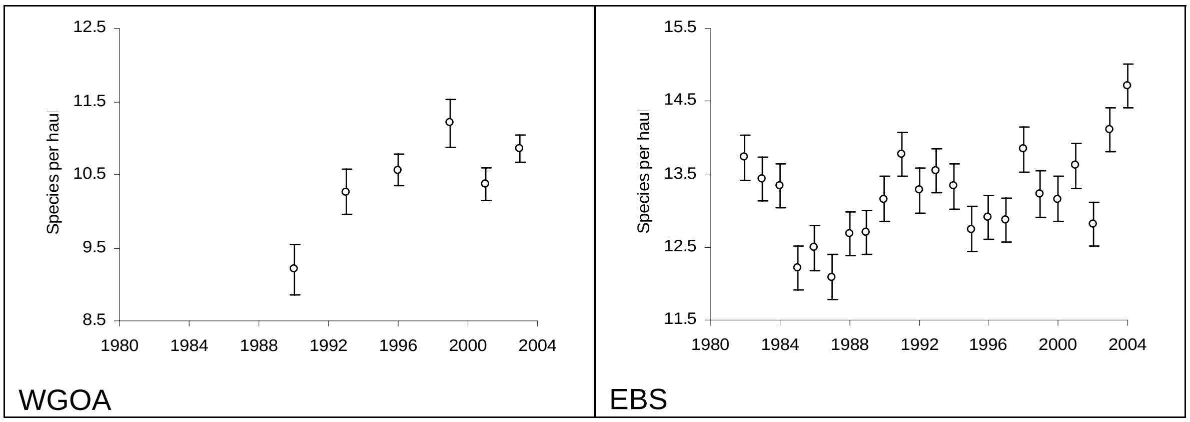
> The effect of fishing on species richness and diversity are poorly understood at present. Because fishing primarily reduces the relative abundance of some of the dominant species in the system, species diversity is expected to increase relative to the unfished state. However, changes in local species richness and diversity are strongly confounded with natural variability in spatial distribution and relative abundance. (Mueter 2005, p. 246).

Table 11-1 specifies indicators for species diversity as (1) population levels of target and non-target species relative to MSST or ESA listing thresholds, linked to fishing removals, (2) bycatch amounts of sensitive (low potential population turnover rates) species that lack population estimates, (3) number of ESA listed marine species, and (4) area closures.

Population levels of target, non-specified, PSC, and forage species were addressed in Chapters 4, 5, 6, and 7 of this EIS.

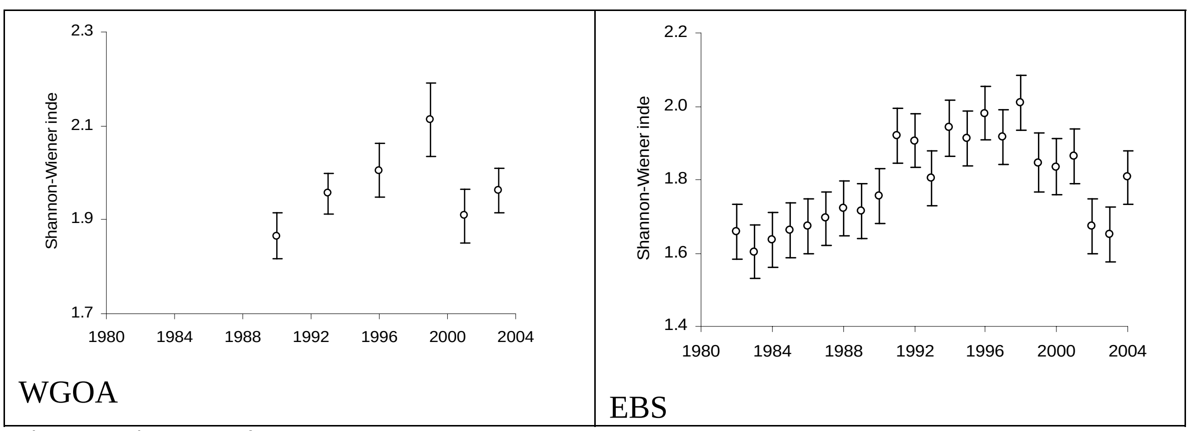
Although no fishing-related species removals have been documented under fisheries management policies in effect during the last 30 years, elasmobranchs (sharks, skates, and rays) are particularly susceptible to removal, and benthic invertebrate species diversity could be affected by bottom trawling (NMFS 2004, p. 26). More comprehensive survey data and life history parameter determinations for skates, sharks, grenadiers, and other species groups may help to determine population status and establish additional protection measures that could minimize adverse impacts from fishing (NMFS 2004, p. 356).

Biota inhabiting habitat areas of particular concern (HAPC) include seapens, seawhips, sponges, anemones, corals, and tunicates. From 1997 to 2005, HAPC biota bycatch in the BSAI ranged between 923 mt in 1999 and 2,548 mt in 1997. Bycatch was dominated by tunicates, sponges and anemones. Over the same period, bycatch in the GOA ranged from 15 mt in 2004 to 46 mt in 2002. Bycatch was dominated by anemones, with lesser amounts of corals and sponges (S. Gaichas, pers. comm., June 2006).



Figures used courtesy of Franz Mueter. August 1, 2006.

Figure 11-2 The richness index of species diversity in the western GOA and EBS



Figures used courtesy of Franz Mueter. August 1, 2006.

Figure 11-3 Shannon-Weiner index of species diversity in the western GOA and EBS

The Council has been taking steps to provide additional protection for non-target species in recent years. In 2003, the Council adopted GOA FMP Amendment 63, which removed GOA skates from the “other species” category, and established OFL, ABC, and TAC levels for three skate species or species groups (69 FR 26313). In 2005, the Council adopted GOA FMP Amendment 69, to modify its procedures for setting the “other species” TAC in the GOA to provide more protection for these species. This change became effective in 2006 (71 FR 12626). In 2005, the AFSC prepared separate SAFE reports for the species in the BSAI “other species” category. In 2006, the AFSC will prepare SAFE reports for other species in both the BSAI and GOA. In 2005, the AFSC projected OFL and ABC levels for grenadiers and will produce a SAFE report for grenadiers in 2006. The Council has a non-target species committee investigating potential approaches to protecting these species. The EFH protection measures that became effective in July 2006 will provide protection to benthic biota in large areas of the AI and GOA. The Council is initiating an investigation of extending these protection measures to the EBS.

Table 3-2 in Section 3.4 of this EIS identifies the ESA-listed and candidate species that range into the BSAI or GOA groundfish management areas. As determined in previous ESA consultation BiOps (NMFS 2000, 2001; USFWS 2003a, 2003b), the alternatives under consideration in this EIS are not expected to change the number of ESA marine species, or the status of existing ESA-listed species. Species currently listed as candidates for ESA listing (northern sea otter and Kittlitz murrelet) have little overlap with groundfish fisheries (NMFS 2004; 69 FR 24876).

Under all the alternatives, currently closed areas (50 CFR 679.22) would be maintained, and current no-trawl zones and fixed-gear restrictions would stay in place. Under the EFH protection measures, which became effective on July 28, 2006, large additional area protections have been implemented in the AI and GOA. The Council is initiating an analysis of EFH in the EBS.

None of the alternatives are associated with changes in closed areas, and none is expected to change the status of ESA-listed species. Other chapters discuss the impacts of the alternatives on non-specified species (Chapter 5), forage species (Chapter 6), prohibited species (Chapter 7), marine mammals (Chapter 8), seabirds (Chapter 9), and habitat (Chapter 10). Generally, the conclusions reached for Alternatives 1 through 4 is that some impact on these components of the environment may occur with the least impact under Alternative 4 and the most under Alternative 1 based on amounts of fishing under each alternative. Alternative 5 would have no impact on diversity because no fishing would occur and therefore no species removals or impacts on habitat would occur.

Functional (trophic and structural habitat) diversity Functional diversity can be altered with respect to trophic or food-web characteristics if removal or depletion of a component of the food web (trophic guild member) occurs. Changes to distribution of biomass within a trophic guild may also result. From a structural habitat standpoint, functional diversity can be altered or damaged if bottom contact fishing methods such as bottom trawling, longlining, pot fishing, or bottom contact with pelagic trawls, remove or deplete organisms that provide structural habitat for other species such as corals, sea anemones, or sponges (NMFS 2004, pp. 355-356).

The impact indicators described in Table 11-1 are characterized by catch removals resulting in a change in functional diversity outside the range of natural variability observed for the system. Three indicators are used with respect to functional diversity: (1) guild diversity or size diversity changes linked to fishing removals, (2) bottom contact gear effort, and (3) HAPC biota bycatch.

The impacts of fishing on trophic levels were evaluated earlier in this section. Figure 11-1 summarized time trends in two indices of trophic level of the catch, calculated for the period from the 1950s to 2003. This discussion will not be repeated here.

As noted in the Ecosystems Considerations chapter of the SAFE, bottom trawl effort has dropped considerably in recent years (Boldt 2005, p. 264). While bottom trawl effort levels are lower than they were in past years, longline gear effort has been increasing in recent years (Boldt 2005, p. 262).

From 1997 to 2005, HAPC biota bycatch in the BSAI ranged between 923 mt in 1999 and 2,548 mt in 1997. Bycatch was dominated by tunicates, sponges and anemones. Over the same period, bycatch in the

GOA ranged from 15 mt in 2004 to 46 mt in 2002. Bycatch was dominated by anemones, with lesser amounts of corals and sponges (S. Gaichas, pers. comm., June 2006).

While Alternative 1 creates much larger TACs for some species taken with bottom trawl gear in the GOA (but not in the BSAI), constraints associated with the marketability of some of these species, and halibut PSC constraints, are likely to prevent the bottom trawl fleet from fully harvesting these TACs. Actual effort increases may be much smaller than suggested by the proportionate change in TACs. Alternatives 3 and 4 are associated with lower TACs for species taken with bottom gear and may be associated with lower catches of HAPC biota. Alternative 5 would be associated with no bottom trawling effort, and will not have an adverse impact on habitat or result in takes of HAPC biota.

Genetic diversity Genetic diversity raises two important issues. First, a stock of fish defined for management purposes is often actually made up of several substocks, each with somewhat different reproduction, growth, mortality, and carrying capacity parameters. For management purposes, stock definition often represents a compromise between administrative tractability and the distinctiveness of substocks. A TAC, and by implication a given fishing mortality rate established for a stock made up of several substocks, may have differential impacts on the various substocks. Some of these substocks may be overfished relative to others, reducing the genetic diversity of the overall population (Walters and Martell 2004, pp. 83-84).

Second, selective fishing, for sex or for size, may affect the genetic make-up of a given stock through time. The impacts can be unexpected. There is evidence that selective fishing for larger fish, in a population that tends to reach sexual maturity at a specific age, may select for slower growing fish, while similarly selective fishing, on a population that tends to reach sexual maturity at a specific weight, may select for faster growing fish. (Walters and Martell 2004, pp. 83-84). Clear-cut cases of changes in fish characteristics due to genetic changes are not easy to find, because many other factors can affect fish characteristics. These might include density dependent effects and environmental factors such as water temperature (Walters and Martell 2004, p. 85; Law and Stokes 2004, p. 241).

The criterion for this impact, from Table 11-1, is an impact on genetic diversity from catch removals large enough to cause a loss or change in one or more genetic components of a stock that would cause the stock biomass to fall below minimum biologically acceptable limits. Indicators for this effect are (1) the degree of fishing on spawning aggregations or larger fish, and (2) the abundances of older age groups of target groundfish stocks. Changes in these indicators are assessed qualitatively by inferences from changes in catch levels and in regulations protecting spawning aggregations and separate biomass concentrations.

If a fishery concentrates on certain spawning aggregations or on older (larger) age classes of a target species that tend to have greater genetic diversity (dating from an earlier period when fishing was less intensive), then genetic diversity will tend to decline in fishing versus unfished systems. Since genetic diversity has not been systematically surveyed, there is no baseline against which changes in genetic diversity may be measured. There are examples of fisheries (i.e., North Sea cod) in which heavy fishing and selection for body length over long periods of time have been found to have little impact on genetic diversity. There has been heavy exploitation of certain spawning aggregations in the past (e.g., Bogoslof pollock), but current spatial-temporal management of the groundfish fishery has tended to reduce fishing pressure on spawning aggregations. Groundfish stocks are often protected by sub-division of ABCs and TACs among management areas within the BSAI and GOA management areas. It is unknown if commercial fishing has altered the genetic diversity of stocks with distinct genetic components at finer spatial scales than the present groundfish management regions (NMFS 2004, p. 27).

The alternatives would not alter spatial and temporal management controls that provide existing protection for spawning stocks and for overexploitation of subdivisions of broader regional stocks.

Moreover, all target harvests will be subject to the Council's OFLs and ABCs, which prevent fishing beyond levels considered sustainable. Alternative 1 has larger TACs than the status quo alternative, and could provide larger harvests in the GOA. However, the largest increase is in the flatfish TACs, and harvests of these species are likely to remain constrained by halibut PSC limits. Alternatives 3 and 4 provide for lower harvests than the status quo and may be associated with reduced potential for genetic impacts. Under Alternative 5 there would be no harvest; this alternative does not have the potential for an adverse impact on genetic diversity.

11.3 Reasonably Foreseeable Future Actions that may Affect the Impact of Groundfish Fishing on Ecosystem Relationships

The following reasonably foreseeable future actions may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on the ecosystem. These types of actions are described in Chapter 3.

Ecosystem-sensitive management

Ongoing research into ecosystem impacts will improve our understanding of the impacts of fishing activity on the interrelationships between fished target stocks, the impacts of fishing bycatch on other resources components such as seabirds, marine mammals, and habitat, and on more systemic measures of a functioning ecosystem (such as species richness and diversity). Other research, such as current research into trawl cable-seabird interactions and salmon and halibut excluder devices, may lead to new ways of operating that may reduce fishery impacts.

Several efforts to manage the impacts of fishing activity on other resource components should reach fruition within the period of the current action. NMFS has adopted a final rule designating new critical habitat for right whales effective in August 7, 2006 (71 FR 38277). Through an EFP, NMFS is gathering information in support of a rule to implement the Council's BSAI FMP Amendment 84, which modifies bycatch reduction measures for Chinook and chum salmon in the BSAI, to reduce incidental catches of these species. The program is being implemented by an EFP in August 2006 and possibly in the beginning of 2007, to evaluate the impact of the provisions.

In 2005, NMFS and the Council completed the EFH EIS (NMFS 2005a). In February 2005, the Council took action to revise its existing descriptions of EFH, adopted a new approach to identifying HAPC, closed 95 percent of the Aleutian Islands to bottom trawling, closed six "coral garden" areas within the Aleutians to all bottom contact gear, prohibited bottom trawling in ten designated areas in the GOA, designated 16 seamounts as HAPC and prohibited the use of bottom contact gear within them, and prohibited the use of bottom contact gear in several small HAPC-designated areas off of Southeast Alaska in order to protect Primnoa corals. NMFS adopted a final rule that made these protection measures effective on July 28, 2006 (71 FR 36694). The Council has initiated evaluation of similar measures for the EBS. Additional information is available at the Council's February newsletter at
http://www.fakr.noaa.gov/npfmc/newsletters/newsletters.htm.

NMFS has adopted a final rule to implement BSAI FMP Amendment 79 that authorized a groundfish retention standard program in the BSAI for trawl catcher/processors (CPs) 125 feet and longer that are not listed under the AFA. The action is intended to reduce bycatch and improve utilization of groundfish harvested by these non-AFA trawl catcher/processors. The effective date is January 20, 2008 (71 FR 17362).

The actions contemplated under this heading should tend to reduce the adverse ecological impacts of future fishing TACs. The steps to reduce the impacts of the fishery on other ecosystem components may be particularly important for the protection of top-level predators such as seabirds, marine mammals and sharks, and for the protection of species and functional diversity in the ecosystem. Ongoing research into modeling of ecosystem components will enable managers incorporate a broad range of ecosystem impacts into the TAC setting process.

Rationalization

Future rationalization programs are likely to reduce the number of fishing vessels active in Alaskan waters, and to reduce effort associated with competitive races for the fish. Current efforts include the rockfish demonstration project in the GOA, the more broad-based GOA rationalization effort, and the movement towards cooperatives for non-AFA trawlers in the BSAI under Amendment 80. As competition for fish resources is reduced, the opportunity costs of addressing bycatch related impacts on other marine resources, including seabirds, marine mammals, and habitat, should also be reduced. As noted in Section 3.3 of this EIS, however, rationalization can also be associated with high-grading, illegal discarding, and under-reporting of harvests. These may be new problems, requiring that rationalization programs be associated with a proportionate commitment to monitoring and enforcement.

Traditional fisheries management

Future groundfish fisheries in 2008-2015 should have impacts on the ecosystem each year that are similar to those described under the direct and indirect impacts discussion in this section. Enforcement responsibilities are also expected to increase over the forecast period. Technical and program changes, such as the improvements in the ability to use VMS and electronic reporting, should improve enforcement and monitoring capabilities.

Future fisheries will impose burdens on the ecosystem similar in type to those described in the direct and indirect impacts section for 2007-2008. However, improvements in ecosystem-sensitive management, particularly with respect to impacts on habitat, seabirds, and marine mammals, as discussed earlier, should mean that, in many cases, the annual impacts of fishing in 2008-2015 on other ecosystem components are potentially less than those described under the direct and indirect impacts for the 2007-2008 action. The increased enforcement responsibilities would be a concern in the absence of new funding; however, these concerns would be mitigated by the technical and program changes described.

The Council has initiated work on an analysis to examine future management needs for non-target species. In April 2005, the Council adopted the following alternatives:

- *Alternative 1.* No action.
- *Alternative 2.* Set aggregate “other species” OFL and ABC for the GOA.
- *Alternative 3.* Break out BSAI skates from the other species category
- *Alternative 4.* Break out BSAI skates and BSAI and GOA sculpins from the other species category
- *Alternative 5.* Eliminate “other species” assemblage and manage squids, skates, sculpins, sharks, and octopi as separate assemblages under specification process
- *Option:* Add grenadiers and other non-specified species that are caught in the fishery.

Additional information on the Council’s efforts may be found on their web site:
http://www.fakr.noaa.gov/npfmc/current_issues/non_target/OSpeciesDiscPaperOct05.pdf

Other Federal, State, and International Agencies

Other agencies will continue to carry out their management, research, and permitting functions as they have in the past. These include the ongoing management, research, permitting, and consultation activities carried out by the USFWS, and the ongoing discharge permitting activities by the EPA and possibly the State of Alaska. Because of its Homeland Security responsibilities, the U.S. Coast Guard is expected to continue with its current level of reduced allocation of resources to fisheries enforcement. The MMS projects numerous oil discoveries off of Alaska during the cumulative effects period. In the near future, it expects to offer tracts off of Cook Inlet for lease.

Private actions

Commercial groundfish fishing in the years 2008 to 2015 is an important class of private actions that may affect the cumulative impact of the 2007-2008 fishing action. These actions were effectively treated above, under the discussion of future TAC setting.

The BSAI and GOA Pollock, Pacific cod, halibut and sablefish fisheries have recently received MSC certification. The MSC principle 2, on which the industry is evaluated, requires that fishing operations allow for the maintenance of the structure, productivity, function, and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends (SCS 2004, p. 22). Because the program requires ongoing monitoring and re-evaluation for certification every five years, and because the program may convey a marketing advantage, MSC certification may change the industry incentives to emphasize environmental impacts to a greater extent. Currently, this certification may only affect the incentives for the certified industry segment since other groundfish sectors have not yet been certified.

Ongoing economic development within Alaska may impact coastal zones, and groundfish species which depend on those zones, through increases in runoff, discharge of pollutants, development of coastal areas, or through increases in coastal transportation and recreational traffic. Development in Alaska remains relatively light, compared to development along other U.S. coastlines. Freight, military, and passenger traffic by large vessels through Alaskan waters may also have potential impacts. Sea traffic could affect ecosystems through oil spills or the introduction of invasive species through hull fouling or ballast water exchanges. As noted above, the MMS predicts oil development activity off of Alaska during the prediction period.

11.4 References

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11.5 Preparer and Persons Consulted

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Chapter 12 Economic and Social Impacts

12.1 Persons that may be affected by this action

The alternative harvest strategies presented in this EIS may impact many classes of persons. These classes include persons who are:
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- involved in the groundfish fishing industry as workers, vessel owners, or limited access rights holders;
- involved in the groundfish processing industry as workers and owners;
- supplying inputs to the groundfish fishing and processing industries;
- involved in the storage, brokering, transportation, wholesale or retail sales of groundfish products;
- living in communities within which groundfish fishermen or processors live or from which they operate;
- living in CDQ communities;
- dependent on subsistence items or living in subsistence communities affected by groundfish fishing;
- recreational fishing for groundfish, or for recreational fish that are themselves affected by groundfish fishing, or working in businesses serving recreational fishermen, or living in communities supporting recreational fishing businesses;
- obtaining services from components of the ecosystem affected by fishing. These may include birdwatchers, ecotourists, persons with existence or option values, and so on, or persons, such as guides or guiding firm owners, involved in delivering those services.

Several NMFS and Council resources have detailed information on the social and economic dimensions of the Federal groundfish fisheries off of Alaska:

- Section 3.9 of the groundfish PSEIS describes the social and economic context for the North Pacific groundfish fisheries. Section 4.9.9 of the PSEIS describes the social and economic impacts of the preferred alternative. Both sections are on the internet at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm.

- The annual Economic SAFE document provides historical economic background for these fisheries. The SAFE prepared in 2005 is on the internet at http://www.fakr.noaa.gov/sustainablefisheries/seis/intro.htm.
- Sepez et al. (2005) provides profiles of 136 Alaskan fishing communities. These profiles are on the internet at http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-160/NOAA-TM-AFSC-160.pdf. Draft profiles for communities in Washington, Oregon, California, and other states are on the internet at http://www.nwfsc.noaa.gov/research/divisions/sd/communityprofiles/index.cfm. These have descriptions of participation by members of these communities in both West Coast and North Pacific fisheries.

12.2 Gross revenue impacts

Gross revenue, under each alternative, has been estimated separately for the fisheries harvesting (a) the BSAI TAC and unspecified reserves, (b) the BSAI CDQ reserve, and (c) the GOA TACs. Revenue is projected for each alternative, separately, for 2007 and 2008, and estimated for the TACs adopted by the Council in the years 2004, 2005, and 2006. The gross revenue impacts of the alternatives are defined with respect to the change between the alternative and the year 2006 estimates.

The 2004 through 2006 revenue estimates were generated through the same estimation process used to produce the projections for the 2007 and 2008 alternatives - in other words, the 2004 through 2006 gross revenues estimates were produced, treating the ABCs and TACs for those years in the same manner as the ABCs and TACs for the alternatives. All gross revenues, were estimated using average 2004 prices.

The method used to prepare these first wholesale gross revenue estimates is described in detail in Appendix F. The model makes a large number of simplifying assumptions.[13] These results must be treated as a rough approximation, with a large margin of error. Note that 2004 through 2006 revenue estimates are not historical revenue estimates, but estimates developed from the model, based on the TAC levels in those years, using the same assumptions that were used for the 2007 and 2008 estimates. The model results shown here, and in the small entity analysis in Chapter 6, are used as an index of the relative impacts of the alternatives on revenues. The use of model estimates back to 2004 provides consistency through the estimates, supporting their use in this role as an index of movements in revenues.

Overall results are summarized for Alternative 2 separately for the BSAI, the BSAI CDQ program, and the GOA, in Tables 12-1 through 12-3. Alternatives 1 through 5 are compared in Figure 12-1. Table 12-4 provides a comparison of overall model results with first wholesale gross revenue estimates for 2004 summarized from the 2004 Economic SAFE.[14]

[13] An important assumption is that the first wholesale and ex-vessel prices received for fish products do not vary as the level of output varies. Economists refer to this as perfectly elastic demand. To the extent that prices vary inversely with output levels, and that demand is less elastic, changes in gross revenues associated with the alternatives would be reduced. A discussion of consumer impacts, later in this section, addresses available information on demand elasticity for these species.

[14] A comparison of model and 2004 historical revenue estimates may be found at the end of this section. In general, the species-specific gross revenue estimates from the model appear to be close to those from the SAFE. The model estimates for flatfish are much smaller, however, than SAFE estimates. The model will never exactly reproduce SAFE estimates for a year, because it uses five year average average catch and retention rates, where the SAFE will use those appropriate for a specific year.

Table 12-1 Estimated and projected BSAI combined gross revenue from 2003-2007 in millions of U.S. dollars

BSAI Combined	Estimated Earned Revenue			Projected Revenue	
	2004	2005	2006	2007 Alt. 2	2008 Alt. 2
Pollock	980.0	982.9	987.1	944.4	827.5
Sablefish	12.9	10.6	12.2	10.9	10.6
Pacific cod	225.7	215.8	197.1	150.9	126.5
Arrowtooth	2.2	2.2	2.4	3.7	27.1
Flathead sole	9.9	10.2	10.2	11.5	27.2
Rock sole	14.9	15.0	15.0	31.1	40.5
Turbot	4.0	4.0	3.1	3.0	3.0
Yellowfin	25.7	27.1	28.6	35.0	32.1
Flats (other)	3.2	2.8	2.8	4.9	36.4
Rockfish	7.4	7.5	7.3	8.5	8.6
Atka	28.1	28.1	28.1	40.5	29.0
Other	2.4	2.6	2.6	2.6	3.2
Column total	1,316.4	1,308.7	1,296.6	1,247.0	1,171.5

Table 12-2 Estimated and projected BSAI CDQ combined gross revenue for 2003-2007 in millions of U.S. dollars

BSAI CDQ Combined	Estimated Earned Revenue			Projected Revenue	
	2004	2005	2006	2007 Alt. 2	2008 Alt. 2
Pollock	115.6	116.0	116.5	111.4	92.0
Sablefish	2.0	1.7	1.9	1.7	1.5
Pacific cod	16.9	16.1	14.7	11.3	9.3
Arrowtooth	0.1	0.1	0.1	0.1	1.0
Flathead sole	0.3	0.3	0.3	0.4	0.8
Rock sole	0.3	0.3	0.3	0.7	0.9
Turbot	0.1	0.1	0.1	0.1	0.1
Yellowfin	2.2	2.3	2.4	2.9	2.7
Flats (other)	0.1	0.1	0.1	0.1	0.8
Rockfish	0.5	0.5	0.5	0.5	0.5
Atka	2.2	2.2	2.2	3.2	2.3
Other	0.2	0.2	0.2	0.2	0.2
Column total	140.4	139.8	139.3	132.7	112.1

Table 12-3 Estimated and projected GOA combined gross revenue for 2003-2007 in millions of U.S. dollars[15]

GOA	Estimated Earned Revenue			Projected Revenue	
Combined	2004	2005	2006	2007 Alt. 2	2008 Alt. 2
Pollock	34.9	45.0	42.1	34.6	35.3
Sablefish	73.7	71.0	66.1	61.0	54.8
Pacific cod	47.2	43.6	51.3	43.9	29.9
Arrowtooth	5.5	5.5	5.5	5.5	5.5
Flathead sole	1.8	1.7	1.5	1.5	1.5
Rex sole	6.0	6.0	4.4	4.9	4.9
Flat (deep)	0.3	0.4	0.5	0.5	0.5
Flat (shallow)	3.4	3.4	3.3	3.3	3.3
Rockfish	14.3	14.8	16.2	16.8	17.3
Atka	0.1	0.1	0.2	0.2	0.2
Skates	1.0	1.2	1.2	1.2	1.2
Other	0.6	0.7	0.7	0.2	0.2
Column total	188.8	193.2	192.8	173.5	154.5

Notes: The skate fishery was in transition during this period. A target fishery emerged in 2003, and skates were moved from the "other fisheries" to the "target" category by FMP amendment in 2004.

[15] An error in the Alternative 2 GOA 2008 rex sole TAC used in the model was discovered too late for revision of the gross revenue estimates. The 2008 rex sole TAC is 12,100 mt rather than the 10,300 mt used to estimate gross revenues. The TAC is reported correctly in Chapter 2. The 2008 rex sole revenues for Alt 2 are underestimated by about $850 thousand, or about 17 percent. A correction will be made in the final EIS.

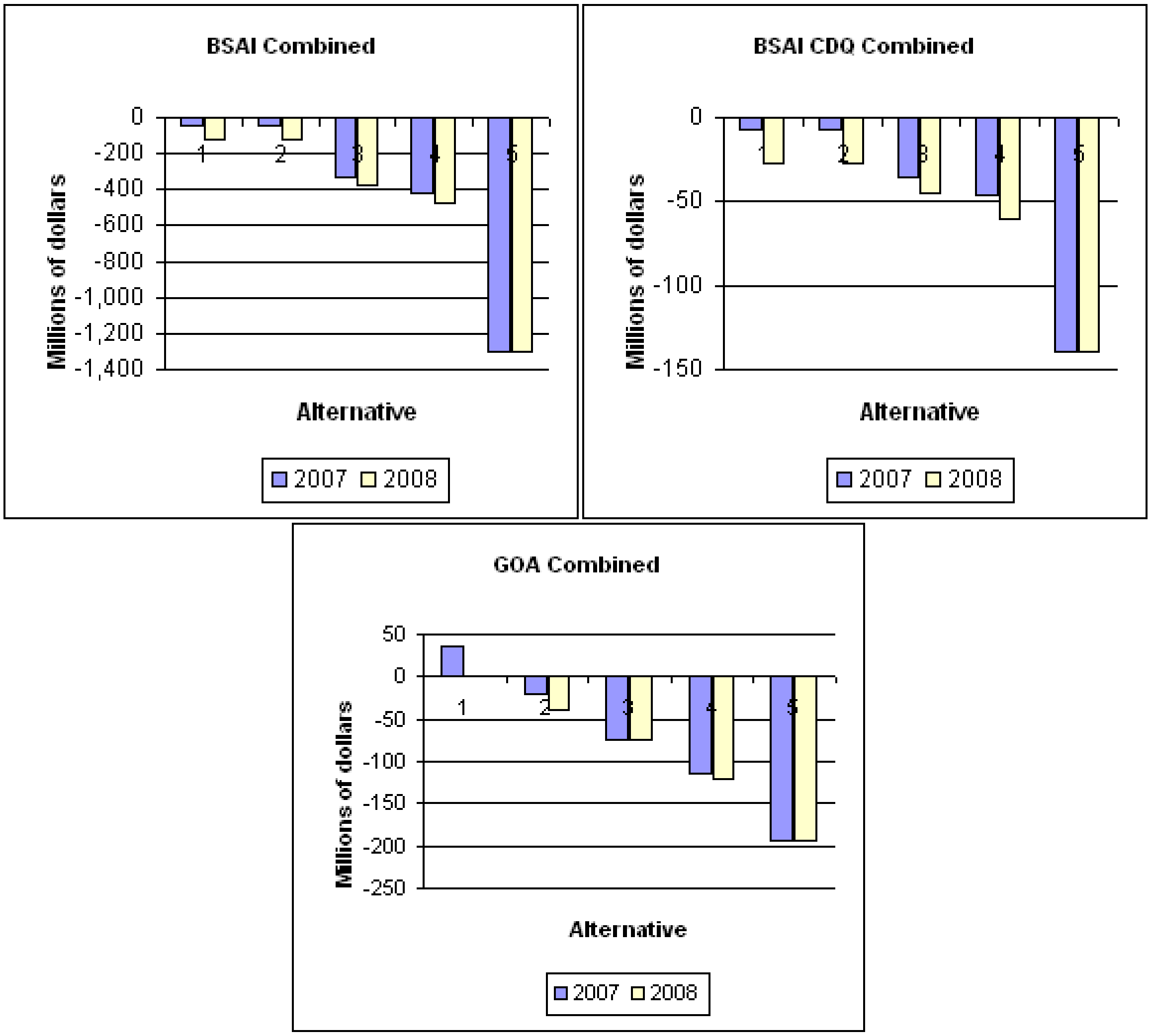


Figure 12-1 Model projections of gross revenue by alternative, sector, and region for 2006 and 2007 in millions of dollars[16]

Total catches for many of the groundfish fisheries were constrained to levels below TACs due to PSC catch. PSC constraints are not proportional to groundfish specifications and are likely to bind sooner, or impose greater costs on groundfish fishermen, assuming higher levels of TAC specifications lead to increased effort. This suggests that projections of gross revenues for alternatives with generally higher levels of specified TAC will tend to be biased upward. This may not be an issue for most alternatives in this analysis, since TACs generally are the same or lower than TACs in 2006. The exception could be Alternative 1, which increases some TACs significantly.

[16] The Alternative 4 TACs are based on Alternative 2 TACs in such a way that a change in one Alt 2 TAC requires changes in all Alt 4 TACs (to ensure the Alt 4 TACs continue to add to 116,000 mt. Therefore, the increase in the 2008 Alt 2 rex sole TAC, discussed in the preceding footnote, requires an increase in the 2008 Alt 4 rex sole TAC and decreases in all other TACs. The net effect on overall gross revenues is less than one percent of overall revenues.

Predicting the portion of increased Alternative 1 TAC that may be caught is problematic. At present, annual halibut PSC is often a binding constraint on flatfish fisheries. In other words, an increase in flatfish TACs associated with Alternative 1 would not necessarily increase flatfish catch, and gross revenues, unless industry is able substantially reduce the rate at which it currently catches halibut. Thus, it is not likely that Alternative 1 flatfish revenue would increase significantly compared to Alternative 2 levels when PSC is taken into consideration. Further, Alternative 1 decreases pollock and Pacific cod TACs relative to 2006 levels. The result, compared to the most recent year, may be increased effort in flatfish fisheries, especially in the GOA. Such a shift in effort could lead to increased halibut catch earlier in the season. Thus, the flatfish TAC alone will not determine how much flatfish is caught. It is a dynamic relationship between TACs for other species, flatfish TACs, PSC rates and constraints, and the resulting effort distribution between other targets, such as pollock and Pacific cod.

The flatfish PSC condition suggests that a conservative analysis might consider Alternative 2 revenue estimates for flatfish (i.e., those most similar to the present specifications) as proxies for what is more likely than the Alternative 1 revenue estimates. Alternative 1 flatfish revenues estimates should be interpreted as upper bound estimates, in the absence of binding PSC constraints.

As a means of comparing model output with tabulated values, Table 12-4 contrasts 2004 aggregated model output (BSAI, BSAI CDQ, and GOA combined) and 2004 revenue estimates, by species group, from Table 25 of the 2005 Economic SAFE document. In total, the model estimates about one percent less total gross revenue than reported in the Economic SAFE. A species by species comparison shows that the model estimates approximately 3 percent more pollock revenue than recorded in the Economic SAFE for 2004. The model also estimates greater revenue for Pacific cod and Atka mackerel than recorded in the Economic SAFE. In contrast, the model estimates less revenue than recorded in the Economic SAFE for sablefish, flatfish, and rockfish.

These differences may arise from estimates of revenue being based on a five year average of catch and retention rates versus an actual accounting of value for 2004. Thus, it is difficult to make exact comparisons, as the methods used to derive these two sets of numbers are inherently different and serve different purposes. The SAFE document is an overall accounting of catch and value from reported data, while the model uses catch and retention data by sector to attempt to predict sector specific revenue associated with future TAC specifications.

Table 12-4 Comparison of 2004 model and Economic SAFE total first wholesale revenue estimates for the North Pacific groundfish fisheries ($ millions)

Species Group	Model	Economic SAFE	Difference	Percent Difference
Pollock	1,131	1,098	33	2.88%
Sablefish	89	95	-6	-7.24%
Pacific cod	290	282	8	2.69%
Flatfish	84	100	-16	-18.82%
Rockfish	22	25	-3	-12.76%
Atka Mackerel	30	29	1	4.55%
Total	**1,646**	**1,661**	**-15**	**-0.93%**

Sources: NMFS-AKR Gross Revenue Model and 2005 Economic SAFE, table 25, page 53.

A description of the approach used to prepare the gross revenue estimates may be found in Appendix F of this EIS.

12.3 Cost impacts

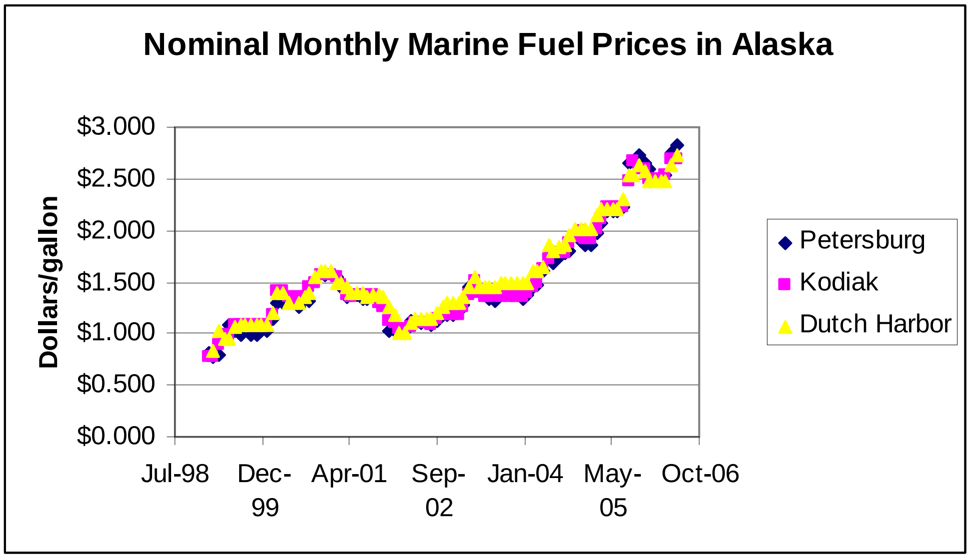
There is very little information on operating and capital costs in the BSAI and GOA groundfish fisheries and processing sectors available for use in this analysis. Complex surveys, as well as the cooperation of the surveyed sector participants, would be required to obtain useful fishing and processing cost information. Once collected, information would need to be continually updated to address evolving operating conditions. Difficult questions of data confidentiality and of the protection of proprietary information will arise. In the past, voluntary survey collection of groundfish cost data has not been successful. These difficulties have been overcome in other fisheries. In Alaska, crab rationalization was associated with the introduction of a mandatory program of cost data collection. Council final action on BSAI Amendment 80, which is to facilitate by-catch reduction in the non-AFA trawl groundfish fishery in the BSAI, includes a provision for mandatory cost data collection.

The classification of costs into variable and fixed categories is not exact, but is instead dependent on the time frame considered. It is important to recognize that fishermen may incur loans to pay for capital goods over extended periods, and that the associated costs may not be avoidable over the length of the loan. Similarly, operators may incur maintenance costs for fishing and processing gear, even if that gear is under- or unemployed in a particular year.

Theoretical models that would predict behavioral changes associated with changes in these TAC specifications and that would generate estimates of cost impacts associated with these behavioral changes are available. However, without empirical information on costs and how they change across fishing operations, and as fishing behavior changes, it is impossible to use these to make numerical estimates of the cost changes associated with the proposed alternatives.

Harvesting, delivering, processing, and transporting larger volumes of fish may be associated with increased total variable costs, although there may be a reduction in cost per unit of output. Conversely, reductions in production imposed by reduced TAC specifications may be associated with decreased total variable costs, although there may be an increase in cost per unit of output.

Having said that, one thing is certain. Fuel is a primary variable input, common to every operation involved in these fisheries. Indeed, expenditures on fuel are typically one of the largest variable costs (along with labor) incurred in this industry. Fuel costs have risen at unprecedented rates in the commercial fishing sector, as they have across the U.S. economy. Data on marine fuel price trends in the region are provided by the Pacific States Marine Fisheries Council (PSMFC). As Figure 12-2 shows, fuel costs have more than doubled since 1999-2000. With no significant opportunity to "substitute" an alternative, lower cost input, at least in the short run, and with the general price inflation pressure on other goods and services, attributable to higher fuel costs across all segments of the economy, the fishing sectors in this region face an uncertain production cost environment.



Source: data supplied by the Pacific States Marine Fisheries Commission. Prices are not indices, but quotes obtained from individual fuel outlets in the indicated towns.

Figure 12-2 Trends in marine fuel prices in Alaska

As noted earlier, it is not currently possible to make quantitative estimates of fishing costs for the different alternatives. Empirical cost models of groundfish fishing that would relate changes in cost estimates to changes in fishing activity associated with different patterns of TACs are not available. The key obstacle is the current lack of industry survey information on costs. On the assumption that costs would be positively, if roughly, related to overall fishing opportunities, it may be that variable operating overall costs would be highest under Alternative 1 in the GOA, and Alternatives 1 and 2 in the BSAI. Costs would likely be lower for Alternatives 3 and 4. Variable operating costs would probably be lowest for Alternative 5, although, as noted below, fixed costs would continue to be incurred under Alternative 5, at least in the short to medium term.

Under Alternative 5, there would be no groundfish fishing. In this circumstance, there would be a large reduction in variable costs incurred by members of the fishing and processing sectors. As noted above, however, firms would continue to incur expenditures associated with fixed costs, such as debt service, service contracts (e.g., accountants, lawyers), and maintenance expenses for existing vessels and processing plants and equipment. If the TACs were permanently set at zero, all those with investments in or linkages to fishing and fish processing in the region would be confronted with transitional expenses, as they move displaced labor and capital into alternative employment. Alternative 5 clearly represents the extreme end of the range of alternatives being considered, however, each alternative under review carries the potential for both variable and fixed cost impacts for at least some current participants. Absent individual firm-level data, the size, significance, and distribution of these impacts cannot be predicted.

12.4 Net returns

Although it has been possible to make rough estimates of gross first wholesale revenues under the alternatives, without cost information, it is not possible to make corresponding estimates of net returns to the fishing and processing industries. As noted, NMFS has little information on the value of capital investments or the operating costs in Alaska's groundfish fisheries. Therefore, treatment of net revenues must be qualitative.

In general, net returns should be larger for fisheries that have been rationalized. This may be the case in the BSAI pollock fisheries, where the AFA allowed fishing and processing operations to rationalize through fishing cooperatives (and a substantially taxpayer funded buy-out of excess capacity). Likewise, rationalization may have contributed positively to net returns in the portions of BSAI groundfish fisheries conducted under the auspices of the CDQs (another subsidy program), and in the sablefish fisheries which operate under an IFQ program. Each of these programs should allow fishermen to operate more efficiently. However, many of the groundfish fisheries in the GOA and the BSAI are conducted in an open-access management mode. While a limited entry program has been adopted, the numbers of permits provide little constraint on fishing effort. Theory suggests that a significant proportion of economic returns should be dissipated in an open access fishery.

Under Alternative 2, the status quo harvest strategy, pollock and Pacific cod TACs decline in the BSAI and GOA. As noted in the section on gross revenues, gross revenues decline as well. Costs are likely to decline as well. Because Alternative 2 is likely to result in different costs and revenues, it is not possible to determine whether net revenues will increase or decrease without additional information on the structure of the cost and revenue functions.[17]

Alternative 1 would increase TACs in the GOA over Alternative 2 levels, thereby likely increasing fishing/processing activity and time at sea, and as noted earlier in this section, may be associated with higher gross revenues to fishing and processing operations. To the extent that fishing operations are unable to take advantage of the increased opportunities under Alternative 1, perhaps because of poor market opportunities or because flatfish harvests are effectively constrained by halibut PSC limits, the revenue effects may be small or non-existent. Price effects could offset some of the potential for revenue increases, although, as noted in the discussion of consumer effects, demand for many of these products may be relatively elastic and price effects may be small. Operating costs would be expected to increase under this scenario. In the BSAI, net return impacts would be the same as those under Alternative 2. As noted, it is not possible to say this for certain without better information on how costs and revenues would change.

Alternatives 3 and 4 generally involve cuts in 2006 TACs. It is likely that these alternative harvest strategies would be associated with reduced revenues; however, as noted, it is not possible to say this for certain without better information on how costs and revenues would change.

Alternative 5 stops all fishing for groundfish. Under this alternative, there would be no groundfish vessels at sea and fishing and processing revenues from groundfish would drop to zero. Nevertheless, owners of fishing and processing operations anticipating renewal of fishing in subsequent years would continue to incur costs associated with the maintenance of their existing assets. Thus, these firms would incur net losses (i.e., negative net returns) during the period.

Many skippers, crew, processing workers, and other industry employees are likely to find some form of alternative employment, although not necessarily in the same geographic location. Others likely will not, especially those that will not or cannot relocate, owing to the chronically high unemployment rates characteristic of the (primarily) rural areas of Alaska. Generally, those that do find work would nonetheless face transitional costs of moving, at least temporarily, into other work. In many cases, they may be unable to find work that is equally satisfying, or as lucrative, as the jobs they left in the fishery.

[17] As pointed out by the SSC in December 2004 (NPFMC 2004, pp. 25-26).

The entire affected unemployment pool, whether reemployed or unemployed, would thus incur a net welfare loss.

12.5 Safety and Health Impacts

Groundfish fishing off Alaska is a dangerous occupation. The average annual fatality rate for groundfish fishing over the period 1990 to 1999, was about 40 fatalities per 100,000 workers (J. Lincoln, pers. comm. July 19, 2006). This is about nine times the annual occupational fatality rate for the United States (4.4 fatalities per 100,000 workers; Lincoln and Conway 2001; pp. 692). The groundfish fatality rate from the 1990's does not reflect changes in the fisheries since 1999. However, it suggests the dangers historically associated with groundfish fishing off of Alaska.

While rough estimates of mortality rates are available for the fishery, much less is known about the connection between fisheries management measures and accident, injury, or fatality rates. Moreover, little is known about risk aversion among fishermen, or the values they place on increases or decreases in different sources and types of risks. Currently, there is no way to connect changes in the harvests, expected under these alternative harvest strategies, with changes in different risks, and the values fishermen place on these changes.

Increases in TACs may improve fishing earnings and lead to greater investments in fishing vessel safety. It may also result in more conservative fishing behavior (e.g., laying up in the face of extreme weather) and greater care by skippers, particularly in rationalized fisheries. This may reduce the fatality rate. In 2001, Jin et al., reported evidence that, given an accident occurs, "the probability of a total loss and the expected number of crew fatalities vary inversely with the price of fish catches" (Jin et al. 2001). In 2005, researchers reported evidence that "higher economic return is associated with lower accident probability," (Jin and Thunberg 2005). Jin and Thunberg considered the price-severity relationship, identified in the 2001 study, as consistent with the results in 2005. The implication is that better economic conditions reduce the likelihood of an accident, and if an accident occurs, reduce the likelihood that it will be severe and result in fatalities.[18]

Conversely, increases in TACs may increase the number of operations, the average crew size per operation, and the average time at sea. These may increase the potential population at risk, and the length of time individuals may be exposed to these risks. Without additional information, the net impact of changes in TACs on fatalities is difficult to determine.

Large negative changes in production, fishing, and processing revenues may be associated with stress and related health problems. The incidence, extent, and potential severity of stress related health problems associated with decreases in revenues is unknown.[19]

[18] Jin and Thunberg look at other factors affecting the probability of an accident. Many of their results are likely to be specific to the fisheries and management approaches in the northeastern United States, and may not be applicable to the Alaska Region. However, their findings suggest the complexity of the issue. For example, while many of their results are intuitive (accidents are more likely when the wind speed is higher), others are not: medium sized vessels appeared to be at greater risk for accidents than larger or smaller vessels, and accidents were more likely closer to shore (Jin and Thunberg 2005).

[19] The difficulties of making projections are illustrated by National Bureau of Economic Research (NBER) studies which find that health outcomes improve as national unemployment rates increase. These are summarized in the Spring 2004 issue of the NBER Reporter. While the reasons for these outcomes are unclear, "one interpretation of some of these findings is that the consumer's time is an important input into the production of his or her health and that the price of this input falls in a recession" (Grossman 2004).

Alternative 1 increases TACs in the GOA, thereby likely increasing fishing/processing activity and time at sea. Increased fishing opportunities will increase the exposure of vessels and crew to potential accidents and thus may be associated with increased numbers of annual accidents. However, if increased TACs lead to greater net returns, then accident rates and injuries and fatalities per accident, may be reduced. To the extent that fishing operations are unable to take advantage of the increased opportunities under Alternative 1, perhaps because of poor market opportunities, or because harvests are effectively constrained by halibut PSC limits, both these effects may be relatively modest.

Alternative 2 sets TACs similar to those in the recent past. The range of fatalities, and of fatality rates, in recent years may provide an indication of the range of results that may be expected under this alternative. Alternatives 3 and 4 generally involve TACs that are smaller than those under Alternative 2. These alternatives may reduce activity on the water and the number of fisherman-days at risk. However, these alternatives are associated with large reductions in gross revenues from the fisheries, and therefore, with reductions in incomes to fishermen, and to others in fishery-income-dependent occupations. If the results of the research by Jin et al. (2001, 2005) can be transferred to Alaska, this may be associated with increased accident rates. Income reductions may introduce new sources of stress and stress-related health problems for those connected with the affected fishing, processing, and support businesses and their families.

Alternative 5 stops all fishing for groundfish. Under this scenario, there would be no groundfish vessels at sea, and fatalities, injuries, and property damage to this sector would drop to zero. While the fishery closure would reduce at-sea accidents, increased stress associated with income loss could have an offsetting effect of unknown magnitude.

12.6 Impacts on Related Fisheries

Specifications decisions can affect several categories of related fisheries including

- commercial fisheries managed by the State of Alaska,
- recreational and subsistence fisheries for groundfish stocks in the GOA and BSAI,
- commercial, recreational, and subsistence fisheries for PSC species,
- fisheries in other regions that target groundfish stocks that produce products that are substitutes or complements for Alaskan groundfish, and
- fisheries related on the production side, either because commercial groundfish fishermen could shift displaced effort to participate in them, or because they do participate in them as part of a diversified package of fishing activities.

The impacts on subsistence and recreational fisheries are discussed in Sections 12.11 and 12.12 of this analysis.

State-waters and parallel fisheries

The State of Alaska manages commercial groundfish fisheries within its waters. Many of these fisheries target stocks covered by this action. Some of these fisheries, called parallel fisheries, occur at the same time as the Federal fisheries, their harvests are counted against the Federal fisheries TACs, and are managed by State regulations that parallel the regulations for the Federal fisheries. Other fisheries, called state-waters fisheries, usually take place when the Federal fisheries are closed, the catches are not counted against Federal TACs, and the fisheries are managed under distinct State regulations.

State-waters fisheries exist for several species of groundfish in internal waters: sablefish in Statistical Areas 649 (Prince William Sound) and 659 (Southeast Inside District); sablefish in the BSAI based on a fraction of the Federal ABC; pollock in Area 649; and Pacific cod in Areas 610 (Shumagin District), 620 (Chirikof District), 630 (Kodiak District), 649 (Prince William Sound), and in the AI (based on 3 percent of the BSAI TAC). The State manages the fisheries in Areas 649 and 659 based on stock surveys conducted by the ADF&G using GHLs. In the case of Pacific cod in the GOA and BSAI, and sablefish in the AI, the GHLs are based on a fraction of the ABC established for the Federal fisheries. In the case of Pacific cod in the GOA and the BSAI, Federal TACs are adjusted down from ABC levels account for State GHLs. The state also manages all species of rockfish in Prince William Sound and Cook Inlet.

State GHLs are not considered a part of this action because they are determined independently of fishery TACs and are not dependent on Council and Secretarial decisions about the TACs. GHLs for the state-waters seasons for sablefish in Prince William Sound and the Southeast Inside District, and for pollock in Prince William Sound, are assessed independently from Federal assessments of these stocks in EEZ waters. NMFS does not consider pollock in Prince William Sound a distinct stock from the western GOA, and includes it in its assessment of the combined Areas 649, 640, 630, 620, and 610 pollock stock. The annual GHL established by the State for Prince William Sound is subtracted from the ABC for the combined stock. None of the alternatives considered would have an effect on the GHLs established by the State for these fisheries. GHLs for Pacific cod in the state-waters seasons are based on a fraction of the Federal ABC apportionments (not to exceed 25 percent in the GOA or 3 percent of the BSAI TAC in the AI). These GHLs would change proportionately with the Federal ABCs established for Pacific cod.

Although GHLs are set independently of this action, the Council's choice of alternatives may affect future stock sizes, and thus future State GHLs. If the Council chose an alternative such as 3, 4, or 5, which would reduce harvests of federally managed pollock and Pacific cod, future stock sizes would be larger, and future State GHLs might be larger. Conversely, if the Council chose Alternative 1 in the GOA, the higher pollock and Pacific cod TACs might be associated with somewhat lower future biomass levels, and possibly with lower future GHLs.

In recent years, the State has modified state-waters GHLs, necessitating changes in Federal TAC deductions. The State is also currently considering establishing fisheries for pollock in its internal waters in several areas from South Central Alaska to the Central Aleutian Islands. Should the State do so, the harvest strategies under consideration in this EIS would result in smaller Federal pollock TACs, all other things being equal, because these harvest strategies presume that the Council and Secretary will accommodate the State.

The State also has management responsibilities for some stocks of fish within the Federal EEZ off of Alaska. Demersal shelf rockfish are (DSR) managed jointly by the State of Alaska (ADF&G) and NMFS. DSR, however, are subject to a TAC included in the harvest strategy alternatives. Prior to 1998, black rockfish (*S. melanops*) and blue rockfish (*S. mystinus*) were included in the pelagic shelf rockfish assemblage in the GOA. However, in 1998 these two species were removed from the Federal management plan and the management jurisdiction for these species was transferred to the State of Alaska (Clausen et al. 2002, p. 384). The Council is currently considering removing dark dusky rockfish from the GOA FMP to permit State management of this species.

PSC Fisheries

Certain species of fish, including salmon (mostly Chinook and chum), halibut, crab, and herring, are taken as bycatch in groundfish fisheries, but are also important targets in other commercial, recreational, and subsistence fisheries. The groundfish FMPs designate these species as prohibited species, prohibit retention of these species (except under carefully controlled conditions), and impose strict controls on PSC. PSC catches are further discussed in Chapter 7.

Chinook and chum salmon are harvested in important Alaska commercial seine, gillnet, and troll fisheries. Some of these Chinook are also believed to recruit into Canadian and U.S. Pacific Northwest target fisheries. Tabular information on changes in catches may be found in Chapter 7. Available evidence suggests that salmon taken in the BSAI pollock fishery come from throughout Alaska, from British Columbia, and Pacific Northwest sources, with a large proportion of each species coming from western Alaska (see Section 12.11 on subsistence).

Chinook and chum salmon bycatch has risen considerably in recent years. While Chinook bycatch was about 8,200 salmon in 2000, it rose in most subsequent years, reaching about 74,800 salmon in 2005. Incidental chum catches were 59,300 salmon in 2000, catches of these also rose in most subsequent years, reaching about 701,200 salmon in 2005. Almost all of these fish were taken in pollock trawl fisheries (see Table 7-1 in this EIS). Preliminary information from the first part of 2006 suggests that salmon bycatch will be high in 2006 as well (Table 7-1 in this EIS). Incidental catches of other salmon species are low.

The reasons for the increase in salmon bycatch are not well understood; however, increased salmon abundance may be a more important factor than fleet behavior. The increase does not appear to be related to changes in pollock TACs or production, since these have been relatively stable over this period. Analysis of seasonal, temporal, and spatial patters of bycatch conducted at the AFSC, suggest that recent higher bycatch levels are likely due to increased salmon abundance, rather than shifting patterns of effort by the pollock fleet (Ianelli 2006). Groundfish fishery impacts on salmon are discussed in more detail in Chapter 7.

FMP Amendment 84, approved by the Council in October 2005 (NPFMC 2006a), modifies the BSAI FMP and regulations to provide more flexibility for industry “hot spot” efforts to address incidental catches of salmon. Under current PSC regulations, fishermen may have been forced out of areas with relatively low salmon incidental catches into areas with higher incidental catches. The new measures are referred to as a voluntary rolling hot spot (VRHS) system. NMFS is currently preparing regulations to implement Amendment 84. In order to provide information on the effectiveness of the Amendment 84 measures and reduce salmon bycatch in the Fall pollock “B” season, NMFS approved an industry exempted fishery permit (EFP) to operate the VRHS system. This is a reasonably foreseeable action that should reduce salmon bycatch for all groundfish harvest strategies. Future efforts to develop a rule to implement Amendment 84 are in abeyance while the results of fishing under the EFP are evaluated.

The impacts of alternative BSAI pollock TACs on Chinook and chum salmon returns to the U.S. are difficult to ascertain. In recent years, it has been hard to predict the potential incidental catch associated with status quo pollock harvests. While it seems likely that, for any given set of environmental conditions including salmon abundance, incidental catches would decline if pollock TACs and harvest were lower, it is not clear that they would decline proportionately. Much would depend on how fleet behavior changed as the available pollock TACs declined. Additional uncertainties are associated with the origins of the salmon by region and by river system within Alaska and from outside sources, the age at which salmon are incidentally caught, and natural mortality and growth rates.

The implications of this increase in incidental catches of Chinook and chum salmon on the numbers and quality of salmon available for subsistence harvest are not clear. Not all PCS salmon originate in the United States, nor recruit to fisheries in regions of Alaska that are heavily dependent on subsistence harvests of these species. There is considerable uncertainty about the proportions of the incidental catch that originate in the different areas. The EA/RIR/IRFA for Amendment 84, which seeks to modify fishing regulations so as to reduce incidental catches of salmon, surveys recent evidence on stock origins

(NPFMC 2006a). For more recent information on the analysis of stock origins, see Wilmot (2006). Significant portions of the chum bycatch appears to originate in Asia (the EIS cites an estimate of 80 percent, but Wilmot provides a lower 41 percent estimate, with 24 percent from western Alaska). Asian stocks appear to be much less important for Chinook salmon (the EIS cites figures indicating that 56 percent of Chinook may come from western Alaska, 31 percent from central Alaska, and 8 percent from southeast Alaska, B.C., and the U.S. West Coast). Many salmon are taken a year or more before they would return to their natal streams and the impact on State salmon fisheries would depend on the offsetting impacts of natural mortality and growth during this period.

In general[20], commercial salmon fishermen are allowed to harvest returning salmon, once in-season escapement goals, anticipated subsistence harvest needs, and projected recreational fishing use levels are provided for. Thus, fluctuations in salmon returns are most likely to be felt by the commercial salmon fishing sector first.

An analysis evaluating the salmon PSC regulatory modifications monetized the incidental salmon catch in the BSAI pollock fishery over the period 1999 through 2003 (NPFMC 2006a). This analysis provided an upper bound on the potential impact on commercial value by assuming that all intercepted salmon would have returned to Alaska, and that there would have been no natural at-sea mortality between the time they would have escaped harvest and the time they returned to their natal streams. Moreover, the analysis did not account for discounting over the period between escape and availability to commercial fishing. The gross value of foregone salmon fishing revenues was estimated to be about $1 million for Chinook and about $250,000 for chum in 2003. The author notes that, because of the assumptions made, the values "greatly overstate the actual harvest that might have occurred if salmon bycatch had not been taken in the Bering Sea pollock trawl fishery (NPFMC 2006a, page 151). They are also estimates of gross revenues to salmon fisheries, rather than net revenues to that sector. Absent a complete accounting of costs and revenues, both to salmon fishermen and to pollock fishermen, the estimates cannot be interpreted as indicative of "net benefit impacts".

Halibut PSC is allocated among different fisheries defined by gears and targets. In some target fisheries, PSC allowances are not typically fully utilized; other fisheries are 'typically' closed down prior to attainment of the target TAC, after fully utilizing the PSC allocation. Halibut quotas are independent of fishing removals in any given year, thus, changes in the proportion of PSC harvested, associated with changes in harvest strategies, would not affect the halibut fisheries in that year. Alternative harvest strategies may affect the halibut fisheries in subsequent years, as changes in existing halibut biomass will affect future halibut biomass through growth, mortality, and reproduction.

In the BSAI, Alternative 1 would not be associated with higher halibut incidental catches than under the status quo. Alternatives 3 and 4 are associated with reduced TACs for Pacific cod. The Pacific cod trawl fishery takes a significant proportion of the halibut bycatch. The longline fishery also takes several hundred metric tons of halibut PSC, although it typically leaves a large portion of its allocation unutilized. Because of the importance of the trawl fishery's share of the bycatch, and because that fishery typically takes a large proportion of its bycatch allowance, Alternatives 3 and 4 may be associated with some reduction in halibut bycatch. Alternative 3 is also associated with reduced TACs for rock sole and yellowfin sole. Both of these fisheries also take halibut bycatch. Thus, if adopted, Alternatives 3 and 4 would be expected to reduce Pacific halibut bycatches.

[20] Clearly, terminal area fisheries lend themselves more readily to this management strategy. Interception fisheries (e.g., S.E. Alaska salmon troll fisheries) are far less selective, in terms of "source of origin", within their catch composition.

In the GOA, the fisheries taking the most halibut PSC are the Pacific cod trawl and longline fisheries, the shallow-water flatfish complex and arrowtooth flounder trawl fisheries, and the rockfish trawl fishery. Alternative 1 does not propose to increase Pacific cod TACs. It would increase the TACs for the shallow-water flatfish and arrowtooth flounder, but these fisheries are both constrained by halibut PSC allocations at current TAC levels. Rockfish harvests are not typically constrained by halibut PSC, and there may be room for a modest increase in halibut PSC bycatch, if this TAC increases. Alternatives 3 and 4 are associated with smaller Pacific cod TACs and may be associated with smaller halibut bycatch. Bycatch not taken by the Pacific cod fishermen may be harvested by the shallow-water flatfish and arrowtooth flounder fishermen, who are fishing against the same TAC, even if their own TACs decrease. Thus, it is not clear whether a decrease in the Pacific cod TAC would be associated with a decrease in halibut PSC harvest. Decreases in shallow-water flatfish and arrowtooth flounder TACs may not be associated with decreases in halibut PSC, as these fisheries are not taking their full TACs currently, owing to halibut bycatch constraints. A decrease in rockfish TACs may be associated with a decrease in halibut PSC. In general, Alternatives 3 and 4, under which TACs decrease relative to the status quo, may be associated with decreases in halibut PSC, but the decreases in halibut PSC are likely to be less than proportional to the TAC decreases.

Changes in the impact of groundfish fishing on commercial harvests of crab, caused by alternative harvest strategies, are believed to be low. In the BSAI, crab PSC limits are specified annually regardless of the groundfish TACs based on annual assessments of crab stock abundance. Therefore, local crab stocks are protected under all of the groundfish harvest alternatives. This combined with the present low crab bycatch in the GOA, coupled with season and area closures to trawl gear on all crab stocks, results in a low impact under all harvest strategies.

A comment submitted during the scoping for this EIS suggested that groundfish fishing in the GOA may have an adverse impact on some Tanner crab fishing grounds and on the quality of crab harvested by fishermen from those grounds. The commenter based his observation on fishing during 2006 (NMFS 2006). At present there is little information on the nature and scope of possible impacts of the harvest alternatives on Tanner crab populations. The ADF&G only surveys a fraction of the GOA for crab, but the areas surveyed are historically the most important areas of crab abundance so survey estimates are believed to be low. In 2005, the area surveyed in the western GOA had an estimated 22.25 million Tanner crab, the estimated take in the groundfish fisheries was 51,705 Tanner crabs, or two tenths of one percent of the estimated biomass. In the area surveyed in the central GOA, the biomass estimate was 83 million Tanner crab and an estimated 184,329 crab were taken in the groundfish fisheries, about half by trawl gear and half by pot gear. This take was about two tenths of one percent of the biomass; the trawl take was one tenth of a percent. Commercial harvests and GHLs of Tanner crab have increased in recent years. Most of the area surveyed by ADF&G is closed to bottom trawls. Area closures are the principal means by which Tanner crab are protected from groundfish fishing activities. It is possible that EFH area closures may provide some extra protection for crab and salmon. Crab PSC caps will be considered under GOA rationalization.

Potential changes in the impact of groundfish fishing on commercial harvests of herring caused by alternative harvest strategies are believed to be small. This is because the herring PSC limit is a small proportion of the biomass (1 percent of estimated biomass in the BSAI), and because of the present low volumes of incidental catch.

Market impacts

Changes in BSAI and GOA groundfish TACs may also affect other fisheries through market impacts. Groundfish products from these areas are substitutes for seafood and non-seafood products produced elsewhere. Large changes in BSAI and GOA production may affect prices elsewhere. These price increases and associated revenue increases, may lead to increased fishing effort in the fisheries for those species. Models of market demand and fishing behavior that would permit estimates of the impacts of the alternatives on the market for other fisheries are not available.

Production impacts

Many of the operations active in groundfish fishing participate in other fisheries as well. Groundfish fishing may provide a way for fishermen to supplement their income from other fisheries and, by doing so, to reduce fishing business risk by diversifying their fishery "portfolios." Moreover, Pacific cod pot fishermen often fish for crab as well, and Pacific cod harvests provide them with low cost, high quality bait. Changes in specifications, and consequent changes in groundfish availability, could lead to more or less activity by groundfish fishermen in other fisheries, affecting competition in those other fisheries.

In general, reductions in groundfish availability would be expected to have a negative effect on related fisheries, as fishermen move out of groundfish fishing and into those activities (to the extent this is permitted under prevailing management rules), or crab fishermen find bait costs rising. Conversely, increases in groundfish availability should have a positive impact on those fisheries. However, little is known about how these processes would take place and what their quantitative impacts would be.

CDQ groups use revenues from their fishing operations to invest in new fishery related activities. Many of these investments take place in fisheries other than groundfish. For example, the Coastal Villages Region Fund operates seasonal halibut buying stations and has invested in a custom salmon processing plant in Quinhagak (ADCED 2001, p. 54). The impact of a reduction in groundfish revenue is difficult to predict. CDQ groups may have smaller revenues to invest in other fishing related activities. However, they may also accelerate their diversification into other non-groundfish fishing activities, in order to offset the risks associated with lower groundfish harvests.

Summary

The alternatives are likely to have little impact on production levels in State-managed fisheries.

It is only possible to make a qualitative statement about the direction of salmon and halibut PSC catches under these alternatives. Halibut PSC is not expected to change from 2006 levels under Alternative 2. Salmon PSC may decline from 2006 levels as pollock TACs decline under the status quo harvest strategy. BSAI Salmon and halibut PSC would be the same as under Alternative 2 in the BSAI. Halibut PSC could increase from Alternative 2 levels somewhat under Alternative 1 in the GOA, due to increased rockfish harvests, and pollock PSC could increase due to pollock TAC increases. Salmon and halibut PSC could decrease from Alternative 2 levels in the BSAI and GOA, but less than proportionately, under Alternatives 3 and 4. There would be no PSC bycatch under Alternative 5. Changes in halibut PSC catches may affect future halibut fisheries through biomass effects.

Changes in production in Alaska groundfish fisheries may affect other fisheries through marketplace interactions. It has not been possible to describe these effects in detail. Changes in production in Alaska groundfish fisheries may affect other fisheries through diversification and joint production effects.

As certain TACs decline from 2006 levels under Alternative 2, the status quo harvest strategy, some operations may seek employment in other fisheries. The impacts under Alternative 1 would be the same as those under Alternative 2 in the BSAI. In the GOA, TACs increase under Alternative 1, but the flatfish TAC increase may be impossible to harvest because of halibut PSC. The net impact on vessel activity is difficult to determine. TACs generally decrease substantially from Alternative 2 levels under Alternatives 3 and 4. These alternatives should be associated with greater movements to other fisheries than

Alternative 2. Alternative 5 sets all TACs equal to zero. This alternative would clearly create strong incentives for fishermen to explore other fisheries (although most fisheries in the U.S. EEZ are fully subscribed and entry into many is strictly limited). It would make it harder for CDQ programs to develop additional local fishery resources (even if it would increase the incentive for them to do so). It would increase prices and incentives to use more effort in fisheries that can be used as substitutes in markets (including many foreign fishery sources that may permanently capture “market-share” from U.S. producers).

12.7 Consumer Effects

Economists typically measure the impacts of changes in production on consumers by changes in consumers’ surplus. Consumers’ surplus is a measure of what consumers would be willing to pay to be able to buy a given amount of a product or service at a given price. A decrease in quantity supplied, and an associated increase in price will reduce consumer welfare as measured by consumers’ surplus. An increase in quantity supplied and a consequent decrease in price will increase consumer welfare as measured by consumers’ surplus. A decrease in consumers’ surplus is not a total loss to society, since some of that loss is usually transferred to producers, in the form of higher prices and an accompanying increase in producers’ surplus. However, this transfer is still a welfare loss to consumers and not all of the consumer loss accrues to produces, so the net impact is negative.

There are few recent empirical evaluations of markets for Alaska groundfish products available. Huppert and Best (2004) have recently reported two simple econometric models of sablefish markets. The most recent econometric analysis of pollock markets is by Herrmann et al. (1996). This analysis used data from 1986 to 1993. Thus, the results of the model are dated and do not reflect changes since 1993. The AFSC is currently supporting work on an econometric model of pollock markets. However, this work is in its early stages and no results are yet available. Halibut are not treated as a groundfish species for the purposes of specifications; however, for completeness, a recent study on halibut demand by Criddle and Herrmann (2004) is also listed here.

The effect of changes in production of pollock, Pacific cod, Atka mackerel, sole, and rockfish products on domestic consumers might be fairly modest, because pollock surimi and roe, and Atka mackerel are principally sold overseas. Pacific cod and pollock fillets are largely sold into domestic markets in which there are many close substitutes (NMFS 2004, pp. 131-134). Moreover, the PSEIS notes that

> …numerous past studies have indicated that the price elasticity of demand for those products, especially fillets, is fairly high…In other words, market price is not appreciably affected by the quantity supplied. This is because the domestic fillet market is competitive in terms of product form…supplying country, and fillets from other species, including hake and hoki. The U.S. market for all fillets, particularly cod, has also been influenced by the increased production of aquaculture-grown whitefish…Furthermore, seafood, in general, must compete with other animal protein sources in the American diet such as chicken, pork and beef. Consequently, the per unit price for pollock or Pacific cod fillets would probably rise only if there were a large decrease in the amount of pollock or Pacific cod fillets supplied to the domestic marketplace by U.S. firms.

Under these circumstances, U.S. consumers may not gain or lose much from modest changes in supply.

The groundfish fisheries also make donations of salmon and halibut PSC to hunger relief organizations under BSAI FMP Amendment 28, and GOA Amendment 29 (NMFS 2004, p. 136).

Without a set of current demand models for the different species under consideration, it is not possible to make quantitative statements about the impacts of the alternative harvest strategies on consumer welfare. The analysis characterizes the alternatives with respect to their deviation from the status quo alternative, Alternative 2.

Alternative 1 has no impact in the BSAI. It may lead to some production increases in the GOA. As a result, this alternative may tend to decrease market prices, and increase consumer surplus for products entering U.S. markets, all other things equal. However, the impacts of Alternative 1 may be limited. The status quo harvests in the GOA are smaller than those in the BSAI. Moreover, much of the Alternative 1 increase consists of flatfish species. As noted earlier, halibut PSC constraints may limit production increases for these species.

Alternatives 3 and 4 lead to some reductions in a number of TACs. Consumer welfare should be smaller under these alternative harvest strategies than under the status quo. Alternative 5 would close Federal groundfish fisheries off Alaska in 2006 and 2007, and, since the Alaska groundfish fisheries are among the largest in the world, would create large reductions in supplies to U.S. consumers (as well as severe disruptions of world seafood markets). This alternative would eliminate the consumers' surplus from consumption of groundfish from the EEZ off Alaska and lead to price increases (and possibly supply shortages) in domestic and world markets for seafood products.

12.8 Management and Enforcement Costs[21]

New estimates of fishery management costs were included in the BSAI and GOA FMP revisions in 2004 (NPFMC 2005a, 2005b). Many agencies are involved in the management of the groundfish fisheries. Among the agencies identified were the NPFMC ($2.4 million annually for groundfish management), the NMFS Alaska Region (about $8 million annually), the AFSC ($28.2 million), the NOAA Office of General Counsel, Alaska Region (no estimate provided just for groundfish, $2 million for all regional activity), the NOAA Office of Law Enforcement ($2.4 million), the U.S. Coast Guard (unable to break out among functions, but less than $40.2 million), the ADF&G (more than $2.5 million), other agencies of the State, such as the Commercial Fisheries Entry Commission, the Department of Environmental Conservation (no estimate given), the USFWS (no estimate given), the Alaska Fisheries Information Network ($0.7 million), and the North Pacific Research Board ($5.5 million) (NPFMC 2005a, pp. 127-133).

The FMPs note that the private sector "…incurs costs that could fairly be described as management costs. These include the costs of 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." Paperwork costs were estimated at $3.7 million, while observer program costs were estimated at more than $10.8 million. (NPFMC 2005a, p. 132).

Enforcement expenses are related to TAC amounts in complicated ways. Larger TACs may mean that more offloads would have to be monitored and that each offload would take longer. Both these factors might increase the enforcement expenses to obtain a given level of compliance. Conversely, smaller TACs may lead to increased enforcement costs, as it becomes necessary to monitor more openings and closures, and to prevent poaching (J. Passer, pers. comm., July 2006).

[21] For a recent collection of papers on the theory of management costs and cost recovery, with case studies, see Schrank et al. (2003).

In-season management expenses are believed to be more closely related to the nature and complexity of the regulations governing the fishery (for example, on the number of separate quota categories that must be monitored and closed on time) than to TAC sizes. Over a wide range of possible specifications, in-season management expenses are largely fixed. For example, increases in TACs from 50 percent above 2004 levels, to 50 percent below 2002 levels could probably be handled with existing in-season management resources[22] (G. Tromble, pers. comm., July 2006).

Without models relating TACs to fishing activity, and fishing activity to management and enforcement costs, it is not possible to make quantitative estimates of changes in management and enforcement costs. The analysis characterizes the alternatives qualitatively, with respect to their deviation from the status quo alternative, Alternative 2. Alternative 1 does not increase overall TACs in the BSAI. Overall TACs in the GOA do increase by at least 50 percent, but the increase is associated with large flatfish TACs that are unlikely to be harvested because of halibut PSC limits. Alternatives 3 and 4 do not change TACs to this extent. In general, none of these alternatives appear likely to create large changes in management and enforcement costs.

Under Alternative 5 there will be no groundfish fishing. Management and enforcement costs would be reduced, but not eliminated. Prohibitions on fishing activity would still need to be enforced to prevent poaching; however, enforcement expenses would be reduced because it would be immediately clear, in any instance, that a vessel found using groundfish gear in Federal waters would be in violation. In-season management expenses and activities would be eliminated if there were no fishing; however, longer term management and research efforts would continue, and unless the elimination of groundfish fishing were expected to be permanent, costs to maintain historical data sets, address legal and administrative requirements contained in Executive Orders and various Acts pertaining to resource management, etc., would continue to accrue.

12.9 Excess Capacity

Open access fisheries are often characterized by excess capacity. This may take the forms of more capital invested in fishing vessels for the purpose of fishing competitively (i.e., capital stuffing), more fishing vessels than are needed to harvest the resource, excessive investment or development of onshore processing plants and other infrastructure, onshore investments in regions that provide competitive advantages in harvesting an open access resource, and more crew or processing workers than would be necessary to harvest the resource if fishing were governed by access rights to the surplus production from the fish stocks. While excess capacity is associated with fishery problems and inefficient use of national resources, reductions in excess capacity create important distributional concerns. Fishery rationalization can mean that crew may experience transitional unemployment or a move to less desirable jobs. In some rural areas without many alternative job opportunities, it may mean that people will face long-term unemployment or that they will have to migrate to find work. It may also mean that communities that benefited from an open access fishery may ‘lose out’ to other communities that would gain under a program of rationalization. The Council takes these considerations into account when designing rationalization programs.

The PSEIS notes that the groundfish fleet expansion in the 1980s and early 1990s led to overcapacity, and that in 1992, the Council adopted its comprehensive rationalization program to address this overcapacity. Since then, the Council has adopted a number of programs that should reduce overcapacity. These

[22] Although at low levels of TACs (but above a zero level) in-season management costs might increase due to the difficulties in managing numerous small quotas.

include the halibut and sablefish individual quota programs, the western Alaska CDQ program, the fishing vessel moratorium of 1995, the groundfish license limitation program of 1998, and the AFA program in the pollock fisheries in 1999, the crab rationalization program which became effective in 2005, and the GOA rockfish pilot project which should become effective in late 2006. As noted in Section 3.2, additional rationalization programs are reasonably foreseeable. The Council approaches rationalization programs seeking to obtain significant benefits from rationalization while addressing distributional concerns as well. The Council often addresses distributional concerns by placing restrictions on the extent to which rationalization programs can reduce overall capacity.

In recent years, researchers have sought to develop methods of measuring excess capacity in fishing fleets. The NMFS Office of Science and Technology maintains a web page providing access to a number of research papers on this issue: http://www.st.nmfs.gov/st5/CommercialFisheriesEconomics.html (these papers are under the heading, “Technical Efficiency, Productivity & Fishing Capacity”).

Staff at the NMFS AFSC have been active in this research effort and have examined capacity levels in Alaskan fisheries (Felthoven et al. 2002; Felthoven and Paul 2004). Felthoven et al. found evidence of excess capacity in groundfish fisheries. Felthoven and Paul examined the special case of pollock catcher/processors in the EBS and found evidence of continuing overcapacity in 2001. This was two years after the pollock fishery had been rationalized under the AFA, including having undergone a substantially subsidized buy-out program for at-sea catcher/processor vessels. The authors noted that this may have been due in part to sideboards and limitations on alternative fishing opportunities, which may have reduced the opportunity costs of continuing to use these vessels in the pollock fisheries and may have slowed the elimination of overcapacity (Felthoven and Paul 2004, p. 631).

Without models relating TACs and available capacity to fishing activity and production, it is not currently possible to make quantitative estimates of the impacts of alternative harvest strategies on capacity utilization. This analysis characterizes the impacts of alternative harvest strategies with respect to their deviation from the status quo alternative, Alternative 2, qualitatively.

Capacity utilization for certain vessel classes may be lower, under the status quo harvest strategy, Alternative 2, than capacity utilization in recent years, as important pollock and Pacific cod TACs in the BSAI decline under this strategy. On the other hand, much of this decline in the BSAI may be offset by increases in flatfish production, using more of the capacity of fleets harvesting these species. Alternative 1 increases TACs in the GOA, but not in the BSAI. Significantly greater TACs may be expected to improve capacity utilization in limited entry fisheries. Note however, that actual harvests may be constrained below the maximums allowed by TACs, as some fisheries run into halibut PSC constraints and must stop fishing. TACs projected under Alternatives 3, and 4 are smaller than those under Alternative 2, and may be associated with reductions in capacity utilization. Under Alternative 5, no groundfish fishing would occur, thus reducing capacity utilization considerably.

12.10 Bycatch and Discards

The Magnuson-Stevens Act National Standard 9 requires that “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. (Magnuson-Stevens Act, Section 301(a)).

Bycatches and takes were analyzed in Chapter 5 (non-specified species), Chapter 6 (forage species), Chapter 7 (PSC species), Chapter 8 (marine mammals) and Chapter 9 (seabirds). The Ecosystems

Considerations SAFE contains information on time trends in bycatch of PSC and non-target species catches, and time trends in groundfish discards.

Halibut, salmon, king crab, Tanner crab, and herring are important species in other directed subsistence, commercial, and recreational fisheries. These species have been designated "prohibited species" in the BSAI and GOA groundfish fisheries. Groundfish fishing operations are required to minimize their incidental harvests of prohibited species and, under most circumstances, to discard prohibited species at-sea with a minimum of injury if they are taken.

PSC regulations are predicated upon economic incentives to encourage fishermen to avoid bycatch (e.g., discard requirements, PSC induced closures of fishing areas and/or entire target fisheries). Regulations that permit charitable disposal of salmon and halibut taken as bycatch reduce the waste associated with discard and mortality of these valuable bycatch species without creating an incentive to target them. Recent regulations requiring the use of streamers on groundfish hook-and-line fishing operations are expected to discourage birds from diving on bait as it is set, resulting on takings in those fisheries.

In the BSAI, prohibited species are protected by harvest limits and/or the closure of areas to directed groundfish fishing if high rates of prohibited species interceptions are encountered. Because of the limits or other protection measures, changes in the harvests in the directed groundfish fisheries associated with the different specifications alternatives should have little impact on catches of prohibited species (excluding, of course, Alternative 5). Chinook and "other" salmon (primarily chums) may be an exception, even among the other alternatives under consideration; as noted in Chapter 7, incidental catches of these species have been high in the BSAI pollock fishery in recent years. Salmon bycatches may be affected by increased or decreased pollock TACs under the different alternatives. Alternative 5 would reduce associated prohibited species catches to zero by shutting down the groundfish fisheries.

Halibut is the only prohibited species managed under a limit in the Gulf. In the GOA, the only bycatch that is meaningful (from a management perspective) in terms of numbers or weight, are (1) Pacific halibut in the Pacific cod, flatfish, and rockfish fisheries; (2) Chinook salmon in the pollock fishery; (3) "other" salmon (primarily chum) in the pollock fishery; and (4) small amounts of *C. bairdi* crab in the Pacific cod fishery.

The Ecosystems Considerations SAFE for 2006 notes that "in 1998, the amount of managed groundfish species discarded in federally-managed groundfish fisheries, dropped to less than 10 percent of the total groundfish catch, in both the Bering Sea/Aleutian Islands, and the Gulf of Alaska… These decreases are explained by reductions in the discard rates of pollock and Pacific cod that resulted from regulations implemented in 1998 prohibiting discards of these two species. Discards in the Gulf of Alaska have increased somewhat since 1998 but are still lower than amounts observed in 1997, prior to the implementation of the improved retention regulations…" (Boldt 2005, p. 257)

Bycatch and discards are analyzed qualitatively, using overall TACs as an index of potential bycatch and discard-generating fishing activity. Bycatch and discards are expected to be similar to those in recent years under the status quo harvest strategy, Alternative 2. Overall TACs remain at the OY in the BSAI and are only slightly below 2006 levels in the GOA. Note that salmon bycatch in the BSAI has fluctuated considerably in recent years (see Table 7-1); status quo bycatch for Chinook and chum salmon may fall within a wide range. Salmon bycatch for any given set of environmental conditions may drop, as pollock fishermen experiment in the Fall of 2006 with new approaches to reducing salmon bycatch in the BSAI under an exempted fishing permit. Implementation of Amendment 80 in the non-AFA trawl fisheries in the BSAI may also reduce discards. Alternative 1 is associated with increased TACs in the GOA, and may be associated with higher bycatch and discards than Alternative 2. Alternatives 3 and 4 are associated with TAC levels that are lower than those under the status quo, and are likely to be associated with lower levels of bycatch and discards for any given set of regulatory and environmental conditions. Under Alternative 5, there would be no groundfish harvests and no bycatch or discards.

12.11 Subsistence hunting and fishing

The commercial groundfish fisheries can affect subsistence hunting and fishing in several ways:

- Commercial fisheries may target stocks, such as rockfish, that are also targeted by subsistence fishermen.
- Commercial groundfish fisheries may take incidental catches of non-groundfish species, such as salmon, crab, and halibut that are also harvested by subsistence fishermen.
- Commercial fisheries may have ecosystem impacts on species used for subsistence if they harvest species used as prey by, that predate on, or that compete with subsistence species. Such impacts may occur with Steller sea lions or with Northern fur seals.
- Subsistence fishermen may earn income in groundfish fisheries that can then be used to support subsistence activities.
- Commercial fishing may result in local depletion of stocks of fish which subsistence users seek. Subsistence users likely have physical (and legal) constraint on their ability to relocate their activities in the face of localized depletion.
- Groundfish processing waste, if improperly discharged, or concentrated in a localized area may adversely impact the value, condition, and availability of harvestable subsistence resources. Spills of other sorts (e.g., fuel) from the groundfish fleet may have a similar localized impact.

Subsistence use of groundfish resources

Subsistence use of groundfish resources in Alaska is described in Section 3.9.5 of the PSEIS (NMFS 2004, pp.95-100). The PSEIS gives brief descriptions of subsistence consumption patterns for coastal communities from the Alaska Peninsula to southeast Alaska. Communities in all the regions described make subsistence use of groundfish. In general, groundfish are a relatively small part of subsistence consumption, ranging from close to zero up to about 9 percent by weight, per capita, depending on the community and year. Species mentioned most often include cod and rockfish. Greenling and flounder are important enough to be mentioned at least once.[23]

Subsistence use of prohibited species

Groundfish fisheries also incidentally catch non-groundfish species that are important to subsistence fishermen. These species include the PSC species, such as salmon and halibut. They may also include incidental catches of non-specified and forage fishes. Incidental prohibited species catches are managed through the incidental catch restrictions imposed on fishing operations by regulation.

PSCs on halibut are fixed limits that cannot be exceeded; these limits lead to closures of directed target fisheries when they are reached. Several fisheries, particularly the flatfish fisheries in the GOA, are routinely shut down before reaching their TACs because they reach halibut PSC limits. Therefore, fluctuations in groundfish harvests are not likely to lead to increases in halibut bycatch beyond these PSC limits. Groundfish fishery impacts on halibut are discussed in more detail in Chapter 7 of this EIS.

[23] Halibut are not an FMP groundfish species, but are a very important subsistence target.

Chinook and "other" (primarily chum) salmon are taken primarily as incidental catch in pollock fisheries. PSC limits for Chinook and other salmon are not absolute. When PSC limits are met, fishing areas may be closed, but fishing operations may be permitted to move to other open areas. Thus, it is possible for fluctuations in pollock TACs and harvests to lead to changes in total salmon bycatch.

Chinook and chum salmon bycatch issues were discussed in detail in Section 12.6 of this chapter (on "Impacts on Related Fisheries"). As shown in Table 7-1 of Chapter 7 of this EIS, Chinook and chum salmon bycatches have risen rapidly in recent years. Almost all of the increase in bycatch has come from the BSAI pollock trawl fleet. The reasons for the increase are not well understood, but appear to be more closely connected with environmental fluctuations than with changes in pollock TACs. The implications of the bycatch for subsistence harvests are not clear. Many of these fish originate from areas outside of Alaska. There is a great deal of uncertainty about the natal regions for fish that do return to Alaska. The allocation of fish between subsistence uses, escapement, and commercial and recreational uses also needs to be taken into account in evaluating the subsistence impact.

Western Alaska salmon subsistence fisheries are a particular concern because of the importance of subsistence in the western Alaska lifestyle, problems with salmon runs there in the recent past, and the proximity of the pollock fishery. ADF&G staff reviewed western Alaska stock status at a salmon bycatch workshop sponsored by the Council in April 2006. The Council's SSC report summarized their presentation as follows:

> … Escapements of chum and Chinook in Kuskokwim Bay have been good since the 1990s. Kuskokwim River chum have had good escapement since about 2000. The outlook for 2006 is for a large run with no commercial harvest. Chinook have had good escapements since 1999 and subsistence harvest is dominant. Continued strong production is anticipated. The Yukon River drainage is very large; about half of the Chinook run is of Canadian origin. Exploitation was high from 1980 to 1986 with no commercial harvest since 2001. Yukon River chum run size and escapement have been increasing since 2002. The outlook is for continued improvement in run size. There has not been a lot of production in the lower river, however. Yukon River fall chum has been classified as a yield concern since 2000 by the Alaska Board of Fisheries. A record run in 2005 followed several years of low production.
>
> Most of the run has ended up on the spawning grounds. The outlook is optimistic for subsistence harvests and a small commercial harvest. The Norton Sound and Port Clarence areas have some yield and management concerns for chum. Escapement and harvest has declined in district 2. Chinook escapement goals have been difficult to attain. Kuskokwim area chum stocks appear to be rebuilt. Northern Norton Sound chum continue to be a concern. There are also continued yield concerns for Chinook in Northern Norton Sound. (NPFMC 2006b; Sandone 2006)

Sections 5.6 and 5.7 EA for BSAI FMP Amendment 84 (NPFMC 2006a) provide more detail on runs and harvests in western Alaska in recent years and discuss the potential implication for subsistence fisheries of the proposed measures to reduce fleet bycatch.

The Council has taken steps to modify the BSAI FMP and regulations so as to increase the flexibility of fleet operations in ways that may reduce salmon bycatch. The Council's Amendment 84, currently in the regulatory process, provides institutional support for private sector cooperatives and contracting to create effective and flexible hot-spot closures. In order to gather information on the potential impact of Amendment 84, NMFS is proceeding with an EFP that will make it possible for key provisions of Amendment 84 to be implemented for the Fall 2006 "B" fishery (J. Anderson, pers. comm., July 3, 2006).

The impacts of alternative BSAI pollock TACs on salmon subsistence fishermen are difficult to predict. As noted in Section 12.6 of this chapter, in recent years it has been hard to predict bycatch. While it seems plausible that, for any given set of environmental conditions, including salmon abundance, bycatch would decline if pollock TACs and harvest were lower, it is not clear that they would decline proportionately. In the limit, of course, salmon abundance could be so great that, even with a very small pollock TAC, bycatches of salmon could be very large. There are also uncertainties associated with how changes in bycatch might be distributed between the U.S. and other nations, among river systems within the U.S., between returns to natal streams and additional at-sea mortality, and among competing uses within Alaska.

Ecosystem impacts on subsistence users

The mechanisms relating changes in the harvest of groundfish prey to changes in populations of animals used for subsistence purposes, and the mechanisms relating changes in populations of animals to changes in subsistence use, are poorly understood.

Impacts of groundfish species on marine mammals were discussed in Chapter 8. Subsistence fishermen exploit a large number of marine mammals, including fur, bearded, harbor, ribbon, ringed, and spotted seals; sea otter; Steller sea lions; walrus; beluga, bowhead, and minke whales (Wolfe 2004).

Groundfish harvests can impact marine mammals through takes (incidental mortality), competition for mammal prey species, and disturbance. In general, commercial groundfish fishing takes for the species used for subsistence appear relatively small (Table 8-3). Competition for prey may be an issue for subsistence harvests of Steller sea lions, and for northern fur, harbor, and spotted seals. Steller sea lions are protected by the Steller sea lion protection measures. Under all alternatives, fisheries would be required to be compliant with these measures, thus none of the alternatives are expected to change the status of Steller sea lions compared to the status quo.

Prey competition in the BSAI would be the same under Alternatives 1 and 2. Alternative 1 in the GOA could increase prey competition, but, except for flatfish, TAC increases are small. While flatfish TAC increases are large, catches will probably be very similar to those under Alternative 2, because of halibut PSC constraints. TACs are smaller than status quo harvests under Alternatives 3, 4, and 5 in the BSAI and GOA. These alternatives may decrease competition for prey between fishing operations and marine mammals. This may be a particular concern for Northern fur seals. Northern fur seal populations have been decreasing for reasons that are not well understood. A recent EIS on fur seal harvests suggested that prey competition for pollock may play a role (NMFS 2005b). However, while there may be a role, very little is known about it, or about how changes in pollock TACs may affect Northern fur seal populations. Chapter 8 noted that disturbance may also have adverse effects on marine mammals. Disturbance is likely to be somewhat, but not greatly, higher in the GOA under Alternative 1, and less in the BSAI and GOA under Alternatives 3, 4, and 5.

The impacts of these alternatives on seabird availability to subsistence hunters are likely to be small, for reasons discussed in Chapter 9. Seabird and seabird eggs play a relatively small proportional part by weight in subsistence diets (Wolfe 2004).

Commercial fishing often provides employment and income needed to support the purchase of equipment and materials used in the pursuit of subsistence activities. Alternatives that affect employment and wages in the commercial fishery can be expected to have indirect impacts on subsistence activities. The discussion of impacts on groundfish revenues, and on revenue impacts to CDQ communities, suggests the likely directional impacts of the different alternatives.

Groundfish income impacts on subsistence users

In general, alternatives that reduce groundfish TACs available to commercial harvest will tend to decrease negative effects on subsistence hunting and fishing, while alternatives that increase TACs available for commercial harvest will tend to increase negative effects. However, the size of these effects is unknown, because of many uncertainties about the links in the chain between groundfish harvests and subsistence harvests. Table 12-5 provides a qualitative summary of potential impacts of the alternatives on subsistence.

Table 12-5 Subsistence impacts relative to status quo (Alternative 2)

	Alternative 1	Alternative 2	Alternatives 3, 4, and 5
Target subsistence stocks	Alternative 2 conclusions apply to this alternative.	Fishing operations are not expected to overfish groundfish stocks, and stocks are not expected to become overfished. In general, subsistence use of groundfish stocks is relatively limited compared to use of other wild resources.	Impacts similar to those under Alternative 2.
Bycatch of subsistence stocks	No increase	BSAI pollock pelagic trawl fishery has been taking large numbers of Chinook and chum salmon in recent years. However, the subsistence impact is not clear. Implementation of FMP Amendment 84 may be reasonably expected to reduce salmon bycatch for given TAC and salmon abundance levels.	These alternatives are associated with lower (or for Alt 5, no) pollock harvests in the BSAI, and may be associated with smaller salmon bycatch than would otherwise be the case. But it is not possible to estimate the magnitude of the impact on salmon availability to subsistence fishermen.
Ecosystem impacts on marine mammal and seabird availability to subsistence hunters	No increase in the BSAI. Possible greater adverse impact on marine mammals in the GOA	Status quo groundfish fisheries have the potential to take marine mammals used by subsistence fishermen, to compete for prey with those animals, and to disturb their normal activities. The status quo impact on sea birds is not believed to have important impacts on subsistence activity.	Alternatives 3 and 4 are associated with lower harvests of species known to be used as prey by marine mammals. This may lead to reduced adverse impacts on marine mammals used for subsistence. However, little information is available about the size of possible impacts. Alt 5 eliminates potential takes, competition for prey, and disturbance to marine mammals.
Groundfish income	Increased in the GOA, no change in the BSAI	Groundfish income less than that received under the status quo harvest strategy in recent years.	Alt 3 and 4 reduce income reduced from status quo levels in the GOA and the BSAI; lower CDQ revenue in the BSAI. Alt 5 eliminates income from groundfish fishing; no CDQ revenues in BSAI.

12.12 Sport fishing

The commercial groundfish fisheries can affect sport fisheries in several ways. Commercial fisheries may target stocks, such as DSR, that are also targeted by sport fishermen. Commercial groundfish fisheries may take incidental catches of groundfish and non-groundfish species, such as lingcod, salmon, and halibut that are prized by sport fishermen. Commercial fisheries may have ecosystem impacts on sportfish species by altering the physical habitat used by these species, or by harvesting species that are predators, prey, or competitors of sportfish species.

Sport groundfish harvests (harvests are retained catches) appear to be dominated by rockfish and lingcod. Some Pacific cod are taken in South Central Alaska. Rockfish and lingcod are sought by sport anglers in southeast and southcentral Alaska, but not to any extent in the AYK Region. From 2000 to 2004, average rockfish harvests were about 133,000 fish, approximately equally divided between Southeast and South Central Alaska. During this period, average annual ling cod harvests were about 27,000 fish, with just under two-thirds coming from Southeast, and just over a third from South Central. Pacific cod harvests averaged about 4,000 fish, all from South Central (Jennings et al 2006, pp. 30-35). Jennings et al. report total sport rockfish harvests. The DSR rockfish stock assessment authors make estimates of sport DSR (yelloweye and quillback and copper rockfish) mortality (from retained plus discarded catches). The authors estimate mortality of 87.4 mt in 2002, 74.1 mt in 2003, and 82.6 mt in 2004. Mortality estimates include retained and discarded harvests. Commercial and research mortality during this period was 350 mt in 2002, 360 mt in 2003, and 450 mt in 2004. Thus, sport mortality ranged between 15 and 20 percent of total sport and commercial mortality during this period (NPFMC 2005b, pp. 786, 799).

Lingcod are not managed under the GOA or BSAI FMPs. Management of lingcod fisheries remains under State jurisdiction, and is not part of this action. Ling cod will not be discussed further. Pacific cod sport harvests are very small compared to commercial harvests. As noted in Section 4.1, Pacific cod are not overfished. As noted in Section 4.2, rockfish species for which Tier 3 assessments are available are not being overfished. Overfishing status for rockfish in other tiers can’t be determined. In the Southeast Alaska DSR rockfish fishery, no directed fishery was permitted in 2005, because sport catch data available prior to the fishery showed a magnitude of sport harvest that precluded a directed commercial fishery in the absence of management action in the sport fishery (NPFMC 2005b, p. 783).

Chinook salmon and halibut are the objects of economically important sport fisheries. “Other” salmon, which are primarily chum salmon, are also taken as incidental catches in sport fisheries, and are the objects of smaller targeted sport fisheries. All five species of salmon found off Alaska, as well as halibut, are PSC species, incidentally harvested subject to PSC constraints contained in the groundfish FMPs and in regulations. The PSC limits on halibut are fixed by regulation and cannot be exceeded. These limits lead to closures of directed target commercial fisheries when they are reached. Several commercial groundfish fisheries, particularly in the GOA, are routinely closed before reaching their TACs, because they reach halibut PSC limits. Therefore, fluctuations in groundfish harvests are not likely to lead to increases in halibut bycatch beyond these PSC limits and would, therefore, not be expected to adversely impact sport use and users of this resource.

Most Chinook and “other”(chum) salmon bycatch is taken in pollock fisheries. PSC limits for Chinook and “other” salmon are not absolute. When PSC limits are met, commercial fishing areas may be closed and fishing operations moved to other areas. Thus, it is possible for fluctuations in pollock TACs and harvests to lead to changes in salmon bycatch. Changes in bycatch may affect sport fisheries. The impact will depend on many factors including the natal streams for the salmon, mortality prior to their return, and allocation among escapement, subsistence, commercial and sport users. Note that, while salmon bycatch has been rising in the BSAI in recent years, the changes in bycatch may have more to do with environmental factors than with changes in pollock TACs (which have been relatively small during this period).

There are two complementary approaches to evaluating the economic impact of groundfish fisheries on sport fisheries. These are Benefit/Cost Analysis and Impact Analysis. A cost and benefit framework would focus on how changes in the availability of groundfish and other fish species to sport fishermen would change demand and consumers’ surplus, by changing CPUE and the characteristics of the available fishing experience. These are economic measures of “benefits” and “costs.” The potential of an alternative to result in local or regional employment or income “impacts” is discussed in the section on community impacts. Both benefit/cost, and impact analyses have been conducted in the past for specific management issues in specific regions of Alaska. The absence of models relating TACs to bycatch of species also taken in sport fisheries, relating bycatch to impacts on sport fisheries (including regional impacts), and systematically relating sport harvests to economic results, makes it impossible to provide a quantitative summary of these economic impacts.

Focusing only on direct impacts, alternatives that reduce groundfish TACs available for commercial harvest may "tend" to decrease negative effects on sport fishing, by reducing competition for groundfish harvested by sport fishermen and by reducing bycatch of salmon. Alternatives that increase TACs available for commercial harvest may "tend" to increase negative effects. It is unlikely that these effects can ever be empirically confirmed, given the complexity and range of variation that exists within these ecosystems. Indirect ecosystem effects may play a role that is unknown at this time. External environmental factors may be more a more important cause of salmon bycatch, for example, than changes in pollock TACs and harvest.

Sport fishery impacts are expected to be similar to those in recent years under the status quo harvest strategy, Alternative 2. There may be a decline in Chinook bycatch in pollock fisheries in the BSAI, as status quo strategy pollock TACs decline. Alternative 1 impacts in the BSAI will be the same as those for Alternative 2. Pollock TACs in the GOA will be higher under Alternative 1, and may be associated with some increased salmon bycatch. TACs under Alternatives 3, 4, and 5 will be smaller than those under Alternative 2, and these alternatives are expected to have a smaller impact on sport fisheries.

While Alternative 5 eliminates all salmon and halibut bycatch associated with commercial groundfish harvesting in the BSAI and GOA, it is not clear how much of the bycatch that would be eliminated would flow to sport fishermen, how much to commercial fishermen targeting non-groundfish species (including PSC species), how much to subsistence users, and how much would be foregone through natural mortality. Additionally, some portion of the fish that would be conserved, by eliminating bycatch in the groundfish fisheries, would contribute to the reproductive potential of the resource.

12.13 Changes in the value of other ecosystem services

Boyd and Banzhaf (2005) define ecosystem services as "the end products of nature that yield human well-being." They note that ecosystem services are not the same thing as ecosystem functions. Functions are the interactions between different elements of the ecosystem itself, while services "…depend on these functions, but are different: they are the aspects of the ecosystem valued by people" (Boyd and Banzhaf 2005, p. 16).

The volumes of groundfish produced by the ecosystem have a value as inputs into commercial, subsistence, and sport fisheries. They contribute a physical product to those fisheries, and they contribute to the cultural and social values associated with participation in those fisheries. The marine ecosystems of the GOA and BSAI also contribute a range of other services and the capacity of the ecosystem functions to generate these (and perhaps yet unrealized) services may be affected, potentially both positively and negatively, by the scale of groundfish fishing.

Many ecosystem services (such as commercial, sport, and subsistence harvests) have already been evaluated in this section. Among the additional ecosystem service values may be values associated with consumptive and non-consumptive uses of ecologically related species; values associated with knowledge of the continued existence of a marine ecosystem with certain characteristics; values associated with preserving the opportunity to use one or more of the ecosystem's services/assets at some future time, and/or preserving that opportunity for future generations; as well as the value of preserving the opportunity to use other resources that are dependent upon the ecosystem.

Some potential uses do not involve actual consumption of physical services. Eco-tourism, to the extent that it is unobtrusive, may be a non-consumptive use of ecosystem services.

A person may never actually use, nor even intend to use, a resource in order to derive value from it.[24] That is, people enjoy a benefit (which can be measured in economic terms) from simply knowing that an aspect of the natural environment exists in a certain state. Such "passive use values" can also arise from a knowledge that activities dependent on the ecosystem continue to take place. Arguably, some place a value on the existence of commercial fishing or on the continued existence of culturally distinct rural Alaskan communities; just as some people (even those living in distant urban centers) receive value from knowing that true wilderness still exists. Passive use values are most likely to exist for resources that are unique or that have few, if any, substitutes. Therefore, it is unlikely, but not inconceivable, that commercial fisheries, or even non-endangered species stocks, have significant passive value.

Many ecosystem services are "public goods." A "public good" is a technical term for a good or service that has one or both of two characteristics: (1) if the good or service is provided to one person in a group, other members of the relevant group can't be prevented from using it at a reasonable cost, and (2) one person's use doesn't reduce the amount available for use by others. The knowledge that, for example, Steller sea lions continue to exist in the wild has both characteristics. If the species is preserved, one person's satisfaction from preservation won't reduce another person's; if the species is preserved, no one can be denied the pleasure of knowing that. Markets often fail to provide socially optimal amounts of public goods.

The absence of conventional markets makes it hard to estimate monetary value for many ecosystem services. Survey research suggests that ecosystem values can be significant, at least in some contexts. For example, survey research from the early 1990s suggests that the cost of ecosystem changes associated with the *Exxon Valdez* grounding and oil spill to persons who simply valued the continued existence of the unaltered environment were on the scale of several billion of dollars. These estimates did not address the loss of other ecosystem services, such as the values accruing to commercial, subsistence, or sport users (Carson et al. 2003).

Estimation of these values is difficult, technically complex, and often very costly. In the present context, it is not possible to derive empirical estimates of values of changes in ecological service flows attributable to the suite of alternative harvest strategies under review. Useful models would need to illustrate the connection between groundfish harvests and impacts on ecosystem function, the connection between changes in ecosystem function and ecosystem services, and the connection between the change in services and consumer welfare. At present, the models to quantitatively describe these connections are not available. Nonetheless, these considerations are appropriately included in the comparative assessment of these competing alternatives, albeit in a qualitative manner.

A clearly delineated class of resources in the GOA and BSAI, whose existence has been identified as at risk, include those that have been formally listed as endangered under the ESA. Under the ESA, an endangered species is one that is in danger of extinction throughout all or a significant portion of its range (16 U.S.C. §1532(6)).

[24] People are said to have an "existence value" for a resource if they place a value on its mere existence, whether or not they ever expect to interact with it. For more information on nonuse values generally, the reader may consult Freeman (2003).

Changes in groundfish harvests in the GOA and the BSAI may impact non-consumptive use values by affecting the availability, probability of continued existence, or recovery of a listed species. At present, four classes of endangered or threatened species range into the GOA and BSAI management areas: (1) Steller sea lions; (2) seven species of whales; (3) Pacific Northwest salmon; and (4) three species of seabirds. Chapter 7 of this EIS described the effects of the alternatives on prohibited species. Chapter 8 described the effects on Marine Mammals (including ESA-listed marine mammals). Chapter 9 described the effects on seabirds (including ESA-listed seabirds).

Alternative 2 is likely to be associated with ecosystem services that are similar to those observed in the recent past. Alternative 1 is likely to be associated with increases in commercial fish production services in the GOA. In connection with this, it may be associated with reductions other services as it takes energy from the system in the form of increased groundfish harvests (probably a relatively minor impact), or if fishing activity has adverse impacts on other ecosystem components (e.g., physical structure, prey/predator relationships). At the other end of the spectrum, Alternative 5, under which no commercial fishing takes place, would reduce use of groundfish and potentially increase other ecosystem services, although again, probably representing a relatively minor impact. Alternatives 3 and 4 would be associated with reduced commercial fish production services from the status quo, and potentially increased other services, although to an unknown extent.

12.14 Communities

The Magnuson-Stevens Act National Standard 8 requires that "conservation and management measures shall, consistent with the conservation requirements of this Act (including 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 (Magnuson-Stevens Act, Section 301(a)).

Changes in fishing activity can affect community employment and income levels through (a) changes in fishing income earned by community members as crewmembers, owners of vessels and other equipment used in the fishery, or as holders of restricted access privileges to participate in the fishery; (b) changes in the quantities of fishing equipment, supplies and services, transportation, and housing services that are purchased from the community; and (c) changes in the levels of fish processing and associated requirements for cold storage, warehousing, transportation, and other goods and services that are purchased from the community.

Many communities also depend on subsistence and sport fisheries for income, sustenance, and the preservation of social, traditional, and cultural values. Commercial fisheries may have a complex relationship to these other flows of ecosystem services. On the one hand, increases in commercial fishing revenues may reduce the need for income from other sources, provide revenues to support subsistence activities, and – if sport fishing is a normal good, so that the quantity demanded increases with income – increase the demand for sport fishing opportunities. On the other hand, as noted above in the discussions of subsistence and sport fisheries, commercial fishing activity may also adversely affect the ability of the ecosystem to provide these services. This may be because of bycatch of a species targeted by a subsistence or sport fishery, or because the commercial fishery harvests a prey species on which the subsistence or sport species depends.

Detailed descriptions of 136 Alaska fishing communities may be found in Sepez et al. (2005). Profiles describe community location, history, demographics, economy and infrastructure, and involvement in the

North Pacific fisheries. Commercial, sport, and subsistence fishing involvement are also covered. Draft profiles containing similar information for communities in Washington, Oregon, California, and other states are available at
http://www.nwfsc.noaa.gov/research/divisions/sd/communityprofiles/index.cfm.

Economic impact analysis

An economic impact analysis could be undertaken to look at how changes in the groundfish harvests affect regional and local economies through employment and income multipliers. Several types of theoretical models are available for addressing economic impacts of fishery on communities. These include simple economic base models, input-output models, social accounting matrix (SAM) models, and computable general equilibrium models. Surveys of regional economic models available for evaluating fishery impacts in the United States (Seung and Waters 2006a) and in Alaska (Seung and Walters 2005) have been completed.

Seung and Waters (2006b) examined the role of the Alaska seafood processing industry in Alaska's economy using a SAM model approach to economic base analysis. Due to lack of data, they were not able to separate the different contributions of groundfish processing, salmon processing, and the processing of other species. They found that seafood processing was an important State industry in 1998. Although employment within the seafood processing industry was about 2.3 percent of total state employment in 1998, about 4.5 percent of the total state employment was attributable to seafood processing industry, taking an export base view. Employment shares would be much higher in the coastal regions where processing is concentrated. The seafood processing accounted for about 3.8 percent of the value of Alaska's output, but about 5.4 percent of the value of its output in the basic (exporting) industries.

Of more potential relevance for evaluating the impacts of changes in groundfish TACs, the Alaska processing industry has had a relatively low output multiplier. The authors note that

> This is because much of the labor income earned in, and expenditures made by, the industry leak out of the state. As was mentioned earlier, 59.5% of labor earnings from seafood processing flow out of the state. In addition, a large portion of intermediate inputs used by the industry is imported; according to IMPLAN data, 69.3% (by value) of intermediate inputs used in 1998 by the seafood processing industry were imported (compared to an average of 43.3% (by value) for the whole state economy). The main commodity imported by the seafood processing industry was raw fish – those fish caught by catcher vessels owned by nonresidents but landed for processing in Alaska.

Another important reason for the low multiplier is the deficiency of IMPLAN harvesting sector data. IMPLAN data does not include many crew members and fishermen who are self-employed or casual or part-time workers. These workers are not covered by state unemployment insurance, and therefore, are not captured in IMPLAN data. To the extent that this harvesting sector employment is underestimated, the results from this study may also be underestimated.

The State-wide multiplier is likely to be relatively high compared to a multiplier calculated for a smaller region of the State, because the leakage from a small part of the State to other parts of the State itself would cause the regional multiplier to be lower. In contrast, the State multiplier is not reduced by purchases of goods and services within the State.

At present, the levels of development of the revenue model used for the specifications analysis, and of the regional impact modeling for Alaska available from NMFS sources, don't permit an employment or income impact analysis of the alternative harvest specification levels. The NMFS Alaska Region is currently developing the gross revenue model in ways that may provide estimates of regional gross revenue flows from the fishery. As Seung and Waters (2006a) emphasized, regional economic models for fisheries do exist while the necessary data to implement the models are either unavailable or unreliable. Therefore, at NMFS AFSC, much emphasis is focused on collection of the data. Although it may eventually be possible to develop an interface between a fishery revenue model and regional impact models to evaluate the regional impacts of alternative specifications in more detail, combining a regional economic model with a revenue model will not be possible until the issue of the data deficiency is resolved.

Concerns about data confidentiality will pose one long-term obstacle to the development of the fine spatial scale required by community level impact modeling. Many communities are served by a single or very few processors, and many only have a few fishermen delivering certain species. In cases like these, community modeling may be precluded by confidentiality concerns, preventing a move beyond a regional impact analysis.

CDQ Program

The Western Alaska CDQ Program was created by the Council in 1991, as part of the inshore/offshore allocations of pollock in the BSAI fishery. As stated in the BSAI Groundfish FMP, the purpose of the CDQ Program as it was developed by the Council was as follows:

> The Western Alaska Community Development Quota Program is established to provide fishermen who reside in western Alaska communities a fair and reasonable opportunity to participate in the Bering Sea/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. Through the creation and implementation of community development plans, western Alaska communities will be able to diversify their local economies, provide community residents with new opportunities to obtain stable, long-term employment, and participate in the Bering Sea/Aleutian Islands fisheries which have been foreclosed to them because of the high capital investment needed to enter the fishery.

The original CDQ Program regulations went into effect on November 18, 1992, and have been amended numerous times since then. In 1996, the Magnuson-Stevens Act institutionalized the program by specifically requiring allocations to the program and establishing community eligibility requirements in statute. Additional amendments to the CDQ Program section of the Magnuson-Stevens Act were made in 2006, and are described in more detail below.

Sixty-five communities are eligible to participate in the CDQ Program. These communities are predominantly Alaska Native villages. The communities are typically remote, isolated settlements with few natural assets with which to develop and sustain a viable diversified economic base. Basic community and social infrastructure is often underdeveloped or completely lacking, and transportation and energy costs are high. Historically, economic opportunities have been few, unemployment rates have been high, and these communities, and the region, have been economically depressed. The 65 eligible communities have formed six non-profit corporations (CDQ groups) to manage and administer the CDQ allocations, investments, and economic development projects. The six CDQ groups are Aleutian Pribilof Island Community Development Association, Bristol Bay Economic Development Corporation, Central Bering Sea Fishermen's Association, Coastal Villages Region Fund, Norton Sound Economic Development Corporation, and the Yukon Delta Fisheries Development Association.

Since 1992, the CDQ Program has expanded several times and now includes allocations of pollock, halibut, sablefish, crab, all of the remaining groundfish species (Pacific cod, Atka mackerel, flatfish, and rockfish), and PSC (i.e., bycatch allowances for salmon, halibut, and crab). CDQ Program allocations vary by species. As part of the AFA, Congress increased the pollock CDQ allocation from the original 7.5 percent, to 10 percent in 1998. The percentage of other catch limits allocated to the CDQ Program (as CDQ reserves) are determined by the BSAI Crab Rationalization Program, which allocates 10 percent of each crab species to the CDQ Program, except for Norton Sound red king crab, which remained at a 7.5 percent allocation; the BSAI groundfish FMP for all other groundfish and prohibited species (7.5 percent of these species is allocated to the CDQ Program, except 20 percent of the fixed gear sablefish TAC is allocated to the CDQ Program); and, 50 CFR part 679 for halibut, which allocates between 20 percent to 100 percent of the BSAI halibut quotas to the CDQ Program, depending on the management area.

Each CDQ group receives a percentage allocation of the CDQ and PSQ reserves. The percentage allocations vary by CDQ group, management area, and species. Between 1992 and 2006, the percentage allocations among the CDQ groups were based on recommendations submitted to NMFS by the State of Alaska. However, on July 11, 2006, the President signed the Coast Guard and Maritime Transportation Act of 2006 (Public Law 109-241; the Coast Guard bill). This legislation revises section 305(i)(1) of the Magnuson-Stevens Act by replacing all of the existing language in this section with new language. One element of these amendments was to establish the percentage allocations of groundfish, halibut, and crab among the CDQ groups at those percentage allocations in effect on March 1, 2006. The Magnuson-Stevens Act now also provides for a decennial review and possible readjustment of up to 10 percent of each of these allocations, starting in 2012.

Under the current regulations, all groundfish (except for squid and “other species”) and prohibited species (except herring) caught by vessels fishing for a particular CDQ group accrues against that group’s CDQ and PSQ allocations. Besides squid and “other species,” none of the groundfish or prohibited species caught in the groundfish CDQ fisheries accrues against the non-CDQ apportionment of TAC or PSC limits. The CDQ groups must manage their catch to stay within each of their annual CDQ allocations, as they are prohibited from exceeding them. This may have a bearing on how successfully or aggressively CDQ groups prosecute some target species.

The 2006 CDQ allocations included approximately 188,000 mt of groundfish, about 910 mt of halibut, and about 2,720 mt of crab. Annual CDQ allocations provide a revenue stream for CDQ groups through various channels, including the direct catch and sale of some species, leasing quota to various harvesting partners, and income from a variety of investments. The six CDQ groups had total revenues in 2004 of approximately $134 million, of which $56 million was earned from royalties from lease of CDQ allocations. The remainder of total revenue less royalties was earned from returns on other assets. Royalties from pollock CDQ was about $46 million in 2004. Since 1992, the CDQ groups have accumulated assets worth approximately $350 million (as of 2004), including ownership of small local processing plants, catcher vessels, and catcher/processors that participate in the groundfish, crab, salmon, and halibut fisheries (Alaska DOCED)

One of the most tangible direct benefits of the CDQ Program has been employment opportunities for western Alaska village residents. CDQ groups have had some successes in securing career track employment for many residents of qualifying communities, and have opened opportunities for non-CDQ Alaskan residents, as well. Jobs generated by the CDQ Program included work aboard a wide range of fishing vessels, internships with the business partners or government agencies, employment at processing plants, and administrative positions. In 2004, approximately 1,800 people were employed in CDQ-related jobs that paid about $12 million in wages. CDQ groups continue to explore the means to provide both continuing and additional employment opportunities for local residents.

The CDQ Program-related amendments to the Magnuson-Stevens Act made through the Coast Guard bill address allocations of groundfish, halibut, and crab to the CDQ Program, allocations of quota among the CDQ groups, management of the CDQ fisheries, eligible communities, limits on allowable investments, the creation of a CDQ Panel, compliance with State of Alaska reporting requirements, and other aspects of program administration and oversight by the State and the NMFS, on behalf of the Secretary. Most of these Magnuson-Stevens Act amendments will require revisions to Federal regulations that will be implemented through proposed and final rulemaking. Amendments also will need to be made to the BSAI groundfish FMP and the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs.

The Magnuson-Stevens Act amendments require the increase in allocations of groundfish to the CDQ Program from 7.5 percent to 10 percent "upon the establishment of a quota program, fishing cooperative, sector allocation, or other rationalization program." Two recent actions to revise sector allocations for Pacific cod (BSAI Amendment 85) and to create cooperatives for non-AFA trawl catcher/processors fishing for flatfish, Atka mackerel, and Pacific ocean perch (BSAI Amendment 80) likely will trigger the requirement to increase the allocations of these species to the CDQ Program from 7.5 percent to 10 percent, once these amendments are approved by the Secretary. These FMP amendments are expected to be effective for the 2008 groundfish fisheries. In addition to future increases in allocations to the CDQ Program, the Coast Guard bill also will require revisions to the management of incidental catch in the groundfish CDQ fisheries to provide an incidental catch allowance for each species in addition to its directed fishing allocation. These requirements will effectively increase the allocation to the CDQ Program beyond 10 percent to provide for the additional incidental catch in the CDQ fisheries that is now authorized by the Magnuson-Stevens Act. The benefits of these increased allocations to the CDQ Program are offset by the costs of the corresponding decrease in allocations for the non-CDQ sectors of the BSAI groundfish fisheries. As this legislation is incorporated into the groundfish FMPs and fishing regulations, it is likely to increase the potential benefits CDQ groups obtain from any given specifications level as a result of increased allocations to the CDQ Program and changes in regulations governing management of the CDQ fisheries and oversight of the economic development aspects of the program.

Summary of impacts

Changes in groundfish fishery TACs would impact fishery dependent communities. In general, specifications associated with TACs that are larger than current levels of production may relax constraints on fishermen and fish processors and could be associated with higher levels of revenues, leading to improvements in the economic conditions in communities that are dependent on fishing activities. In contrast, and under the same set of caveats, lower TACs would increase the constraints on fishermen and would likely result in lower revenues, and may have negative effects on the economies of communities that are dependent on fishing activities. Such effects may be differentially distributed across communities, if, for example, the commercial pollock TAC in the EBS were significantly reduced. In this instance, the value to commercial fishing companies, associated with acquiring access to CDQ allocations, could increase dramatically with associated revenue increases accruing to CDQ communities and higher access costs imposed on non-CDQ communities.

The approach used here, therefore, treats aggregate gross revenues generated by fishing activity in the BSAI and GOA as a proxy for gross revenues accruing to coastal communities in the region. This is a rough measure. While it may be useful to identify the direction of an impact, it does not provide information about the magnitude of the impact. It does not account for the relative proportions of harvest taken by catcher vessels and catcher processors, or account for shoreside delivery locations, or the residences of recipients of different categories of income. In addition, for reasons noted earlier, the data and models are not yet available to make estimates of community or regional employment or income impacts of fishing activity.

Alternative 2 is the status quo harvest strategy in both the BSAI and GOA. Tables 12.1 to 12.3 show that BSAI non-CDQ and CDQ gross revenues and GOA gross revenues are expected to decrease from recent levels under this alternative. Revenues flowing to communities, through CDQ and non-CDQ channels, and generating local income and employment multiplier effects, may be somewhat less than in the past.

Figure 12-1 compares the difference in estimated gross revenues under each alternative with estimated revenues for 2006. Alternative 1 revenues will be the same as those under Alternative 2 in the BSAI, probably similar to or slightly higher than Alternative 2 in the GOA. The increase in the sum of total TACs in the GOA is largely caused by increases in flatfish TACs, but halibut PSC limits are likely to prevent actual flatfish harvests from rising above those in recent years. Revenues from commercial fishing and processing accruing to communities are likely to drop considerably under Alternatives 3 and 4. These revenues under Alternative 3 are likely to be higher than those under Alternative 4. Alternative 5 would generate no commercial fishing revenues in local communities.

Alternative 1 is likely to be associated with increases in the commercial harvests in the GOA. While this may have benefits to communities, as noted near the start of this subsection, it may also have adverse impacts on community subsistence and sport fisheries. At the other end of the spectrum, Alternative 5 would eliminate commercial use of groundfish and potentially increase flows of other ecosystem services, although almost certainly not sufficiently to offset the adverse income, employment, social, and related impacts, or the welfare losses accruing from such a radical management action.

12.15 Energy consumption

For each target fishery, energy costs are associated with traveling, finding, catching, processing, marketing, and delivering the available TAC. These costs can be expressed as energy use per ton of processed product, one measure of the energy efficiency of the fishery. The energy efficiency varies extensively between target species, gear types, and areas, etc., and is primarily a function of the following factors:

- travel distance,
- catch per unit effort,
- vessel capacity, speed, and fuel type
- gear type/mode of operation, and
- vessel displacement and available horsepower.

The total energy cost for a given fishery is the energy efficiency, multiplied by the tonnage harvested. Fisheries management decisions that affect the amount of quota available for harvest will indirectly affect the total amount of energy required to harvest that quota. Thus, management regimes that result in more than marginally lower TACs will likely result in lowered aggregate energy usage for the fishery. Under some management decisions, e.g., short and frequent openings over an extended season, a smaller TAC may not yield this outcome. However, the energy savings that result from TAC reductions are somewhat illusory because, for instance, to the extent that the demand for fish products is inelastic, reducing harvest in one fishery simply serves to increase production in another. The latter fishery may or may not be more energy efficient. On the other hand, fisheries management decisions that affect the dynamics of how a fishery is conducted will directly affect the energy cost per ton for the fishery. Management actions such as area closures and gear restrictions generally decrease energy efficiency for the managed fishery. Conversely, energy efficiency can be increased by closing distant fishing grounds, or restricting fishing to areas with large concentrations of target species.

There are insufficient data to perform a quantitative analysis of the energy costs associated with BSAI and GOA groundfish fisheries.

12.16 Historic places

The CEQ regulations (at 1508.27(b)(8)) for implementing NEPA require the EIS analyze whether the proposed action may affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historic resources.

Due to the nature of the action, which is to set TAC specifications for the GOA and BSAI groundfish fisheries, this action will have no effect on districts, sites, highways, structures, or objects listed in or eligible for the National Register of Historic Places or cause loss or destruction of significant scientific, cultural, or historic resources.

12.17 Reasonably foreseeable future actions that may alter the social and economic impacts of this action

The following reasonably foreseeable future actions may have a continuing, additive and meaningful relationship to the direct and indirect effects of the alternatives on economic and social dimensions of the environment.

Ecosystem-sensitive management

Ecosystem-sensitive management, particularly management that imposes constraints on fishing operations to protect other components of the ecosystem (non-target fish species, birds, mammals, habitat, ecosystem functions), is likely to impose additional costs on fishermen, reduce their CPUE, reduce the fish resources available to them, or otherwise increase their costs and reduce their revenues. Increased regulatory requirements are likely to be associated with increased costs for fishery management and enforcement. Regulations that work by increasing the number of separate quotas that must be monitored may increase fishery management and enforcement costs and could make it more difficult for fishermen to fully harvest available TACs. Ecosystem approaches should also contribute to the long-term sustainability of target fish stocks and the sustainability and continuing value received from other ecosystem services flows, including those from passive use, subsistence use and sport harvests.

Several new regulatory measures may provide increased protection to ecosystem components and increase the values of non-commercial ecosystem flows (but may increase commercial fishing costs):

- The Council has begun a process of evaluating EFH protection in the EBS. The protection measures that may be adopted, if any, and the date of implementation, cannot currently be predicted. New protection measures may increase operating costs for fisheries.
- The Steller sea lion protection measures may be modified. These changes may be a result of recommendations by the Council based on a review of the current protection measures, potential State actions, or recommendations of the Steller Sea Lion Recovery Plan. Any change in protection measures would be unlikely to result in the PBR being exceeded. New protection measures may have an impact on operating costs and will likely result in ESA section 7 consultation.

- Future actions for improved management of fur seals will likely result from the increased concern that has been demonstrated by the Council in the formation of the Fur Seal Committee and the continued development of information regarding groundfish fishery interactions with fur seals. The timing and nature of potential future protection measures for fur seals are unknown, but any action is likely to reduce the adverse effects of the groundfish fisheries on fur seals.

The Council has recently begun to consider modifying its regulations requiring seabird avoidance measures for vessels operating in certain inshore areas. This action may result in reduced costs for longline fishermen.

BSAI Amendments 84a and 84b are intended to reduce salmon incidental take in the pollock trawl fisheries in the BSAI. As discussed above, these have been approved by the Council. NMFS is currently gathering information to support a proposed rule to implement these measures. In August 2006, NMFS issued an EFP in order to learn whether they will be effective starting with the Fall 2006 "B" pollock fishery. An additional EFP may be issue for the Winter 2007 fishery to provide additional information.

Rationalization

Ongoing rationalization programs should have important efficiency impacts, and should contribute to enhancing the profitability of commercial groundfish target fisheries. With the elimination or mitigation of the "race for the fish," fishing operations should be able to develop optimal configurations for harvesting and processing, holding, and delivering, their products. It should be possible to harvest a given quota for a species in a rationalized fishery with at lower cost, and to produce an optimal output configuration given the fishery, costs, and the market. Rationalization programs will also have important distributional impacts. Rationalization, associated with reductions in the numbers of operating vessels or groundfish processors, may reduce the number of people employed in fishing and processing jobs, and may affect the locations of those jobs, with consequent regional economic impacts.

Fishing began under the BSAI Crab Rationalization Program in August 2005. A study of the impacts of rationalization on the City of Kodiak indicates that total fishing effort and the number of crew positions both declined by large amounts during the first fishing season conducted under rationalization (Knapp 2006). Fewer Kodiak boats participated in the Bristol Bay red king crab and snow crab fisheries, and Kodiak resident earnings from the red king crab fishery were estimated to have dropped between $1.0 and $1.6 million. The study notes that the remaining jobs are generally associated with longer seasons, greater total income, lower earnings per day fishing (but not necessarily per day worked), more certainty about income, and declines in the crew compensation as a share of total ex-vessel value. The study noted that "rationalization has cut into sales of some Kodiak businesses which supply and service the crab fleet – but there has been no obvious major decline for marine supply and service companies since rationalization began." Moreover, "Kodiak is a relatively large and diversified community that depends on many fisheries and other activities. This tends to dampen the relative economic effects of crab rationalization on Kodiak." The author notes that "many factors besides rationalization affect crab fisheries, and many factors besides crab fisheries affect Kodiak's economy – making it difficult to identify the specific effects of crab rationalization on Kodiak."

At this early stage, little scientific research has been done on the social and economic impacts of the Crab Rationalization Program. A data collection program was designed as an integral part of the crab program. NMFS and ADF&G will present the first annual report on the program to the Council in December 2006. The Council will receive an initial analysis of some program impacts in April 2007. The labor market, and possible indirect economic impacts of the program, has generated considerable controversy. Crab rationalization, and its impacts on fishing communities, is part of the context within which groundfish specifications will be implemented. The impacts of the crab program may also affect the direction of other Council rationalization efforts. More information on the Crab Rationalization Program is available on the internet at http://www.fakr.noaa.gov/sustainablefisheries/crab/crfaq.htm .

Two other rationalization programs are reasonably foreseeable at this time. In June 2006, the Council approved a bycatch reduction program for the BSAI in the head-and-gut factory trawler fleet, which targets flatfish, Pacific cod, and Atka mackerel (Amendment 80 to the FMP for Groundfish in the BSAI). Incidental to the bycatch reduction, the elements of this program may offer head-and-gut operations opportunities for more rationalized (i.e., economical cost efficient) harvest. In the GOA, the Rockfish Pilot Program will rationalize the rockfish fishery in the Central GOA. This is a two-year pilot project that allows harvesters to form voluntary cooperatives and receive an exclusive harvest privilege to a specific amount of groundfish, by species, in the Central GOA. Processors can form associations with inshore harvester cooperatives for exclusive processing opportunities. The program should permit increases in fishing and processing efficiency, while constraining unwanted fleet or processing consolidation. Provisions for use of PSC may create incentives to conserve on PSC quota use, and make it possible to make increased target fishery harvests, for a given PSC allocation. Net revenues from fishing and processing should increase, but to an unknown extent.

The Council is considering rationalization in the GOA groundfish fisheries, but at this time the nature of a program and a date for implementation cannot be predicted. The ongoing debate over the impacts of the crab program may affect the design of a possible groundfish program. Moreover, an effective program may depend on the adoption of complementary legislation by the State of Alaska, since the groundfish fisheries conducted under the TAC specification take place in both State waters and Federal waters of the EEZ. In the future, the Council may consider a rationalization program in the BSAI Pacific cod fishery. Current Council action on the allocation of Pacific cod among industry sectors may lay part of the groundwork for a future program. However, the design, and implementation date, of any BSAI Pacific cod program, can't be predicted at this time.

As noted in Section 12.14 of this chapter, the CDQ section of the Magnuson-Stevens Act has been revised through the Coast Guard bill. As this legislation is incorporated in the groundfish FMPs and fishing regulations, it is likely to have the effect of generally increasing the potential benefits CDQ groups obtain from any given specifications levels as a result of increased allocations to the CDQ Program and changes in regulations governing management of the CDQ fisheries and oversight of the economic development aspects of the program. More details about the legislation may be found in Section 12.14.

Rationalization may make it possible to achieve ecosystem and environmental objectives, while avoiding unduly high cost burdens on industry. Rationalization programs may contribute to increases in management and enforcement costs. The restructuring of fisheries that often follows rationalization may lead to temporary unemployment, or a shift to less desirable employment for some. Some communities which depend on the business associated with open access fisheries may see that business move to other communities. Increased use of community quotas in rationalization programs may anchor fishing income in rural communities. The actual impacts of rationalization will depend on the decisions that the Council makes in designing and implementing its rationalization programs. Increases in CDQ group income and assets may be associated with increased fisheries development in western Alaska.

Traditional management tools

The Council will authorize groundfish fisheries in future years. Increasing regulatory protections for resource components and increasing rationalization will both increase the costs of fisheries management and enforcement.

A large proportion of the groundfish fleet now carries VMS due to VMS requirements introduced in connection with the Steller sea lion protection measures, EFH/HAPC protection measures, and crab rationalization. In-season managers currently use VMS intensively to manage fisheries so that harvests are as close to TACs as possible. VMS has also become a valuable diagnostic tool for addressing situations with unexpected harvests. It was used as a diagnostic tool in July 2006 to investigate the sources of a sudden and unexpected bycatch of squid. As agency experience with VMS grows, it should allow in-season managers to more precisely match harvests to TACs, thus reducing potential overages and increasing the value of TACs to industry. Extension of VMS will be associated with larger costs for vessels that must adopt it.

A socioeconomic data collection program would be implemented under the Amendment 80 non-AFA trawl catcher/processor cooperative program. The program would collect cost, revenue, ownership, and employment data on a periodic basis, for a portion of the fishing industry operating off Alaska. The purpose of the data collection program is to understand the economic effects of Amendment 80 on vessels or entities regulated by that action, and to inform future management actions. The data are needed to assess whether Amendment 80 addresses goals in the problem statement to mitigate to some degree the costs associated with bycatch reduction. Data would be used by Council and agency staff, recognizing that confidentiality is of paramount importance.

Economic data collected under this program include employment data by vessel collected to determine the labor amounts and costs for the sector. In addition, revenue and cost data by vessel will be collected to evaluate trends in returns to the sector that may be compared with elements of the Amendment 80 program, such as bycatch reduction measures.

Other Federal, State, and International actions

The State may expand State-managed or State parallel groundfish fisheries. While the State sets its quotas in its managed fisheries, adjustments are typically made to Federal TACs to keep combined State and Federal harvests of the relevant species below the ABC and OFL for that species. State parallel fisheries are conducted within the Federal TACs. The State is considering opening new pollock fisheries in Cook Inlet and in the Aleutians Islands near Adak. The BOF is scheduled to discuss this in October 2006 (H. Savikko, pers. comm., July 18, 2006). Depending on the action the State takes, the action could have impact on pollock stocks. In February 2006, the BOF created a new Pacific cod fishery in State waters in the Aleutian Islands. In 2006, NMFS responded to this action with an in-season action decreasing the Federal BSAI Pacific cod TAC by 3 percent. If the State continues this fishery, the Council and NMFS are expected to continue to modify TACs to accommodate it within the overall ABC for the BSAI (M. Furuness, pers. comm., July 18, 2006) These State actions may lead to a reallocation of the revenues from fishermen active in federally managed fisheries to fishermen active in State managed fisheries.

Private actions

Fishermen will continue to fish for groundfish and other species as authorized by the Council, NMFS, the State of Alaska, and the IPHC. This fishing constitutes the most important class of reasonably foreseeable future private actions. Additional groundfish fisheries will take place from 2008 to 2015, the years in the time horizon adopted for this action that are not covered by the 2006-2007 specifications.

In 2004, 913 catcher vessels fished part of Federal TACs off of Alaska; 633 used hook-and-line gear, 199 used pot gear, and 151 used trawl gear. That same year, 83 catcher-processors operated off of Alaska; 41 of these used hook-and-line gear, 4 used pot gear, and 40 used trawl gear (Hiatt 2005). As noted in the section on rationalization, rationalization programs currently being implemented, or under consideration, can reasonably be expected to reduce the total number of fishing operations in Federal waters off of Alaska in coming years.

The MSC is a non-profit organization that purports to promote the sustainability of fishery resources through a program of certifying fisheries that are well managed with respect to environmental impacts. Certification is believed to convey an advantage to industry in the marketplace, by making products more attractive to those consumers who are sensitive to environmental concerns. A fishery must undergo a rigorous review of its environmental impact to achieve certification. Fisheries are evaluated with respect to the potential for overfishing or recovery of target stocks, the potential for the impacts on the structure, productivity, function, and diversity of the ecosystem, and the extent to which fishery management respects laws and standards, and mandates responsible and sustainable use of the resource (SCS 2004, pp. 21-23). Once certified, fisheries are subject to ongoing monitoring and other requirements for recertification.

The BSAI and GOA pollock fisheries, Pacific cod, halibut, and sablefish fishery, have recently received MSC certification. The BSAI freezer longline Pacific cod fishery is currently undergoing an evaluation that may lead to certification. Because the program requires ongoing monitoring and reevaluation for certification every five years (SCS 2004, pp. 241-242), and because the program may convey a marketing advantage, MSC certification may change the industry incentive structure to increase sensitivity to environmental impacts. This certification currently may only affect the incentives for the pollock fishery, since other groundfish sectors have not yet been certified. Certification of these other fisheries cannot currently be considered reasonably foreseeable.

Alaska's population has grown by over 100,000 persons since 1990 (U.S. Census Bureau web page accessed at http://www.census.gov/ on July 14, 2005). A mid-point estimate of Alaska's population in June 2005 is about 662,000. The Alaska State Demographer's mid-point projection for the end of the forecast period of this analysis (2015) is about 734,000, an 11 percent increase (Williams 2005, p. 8). In Alaska, the success of the CDQ program and the expansion of such community based allocation programs in the future (as discussed earlier) may lead to population growth in affected communities.

A growing population will create a larger environmental "footprint," and increase the demand for marine environmental services. A larger population will be associated with more economic activity from increased cargo traffic from other states, more recreational traffic, potential development of lands along the margin of the marine waters, increased waste disposal requirements, and increased demand for subsistence, personal-use, and recreational fishing opportunities.

Alaska's population has also grown in its coastal regions, and is expected to continue to grow (Crossett et al. 2004). Population growth in these regions may have larger impacts on groundfish stocks than growth in inland areas. So far, Alaska's total population growth in coastal areas remains low compared to that in other states. Alaska had the second largest percentage change in growth over the period from 1980 to 2002, but this percent was calculated from a relatively low base. Its coastal population grew by about 63 percent. Alaska has the smallest coastal population density of all the states, with an average of 1.4 persons per square mile in 2003. By comparison, coastal densities were 641 persons per square mile in the northeastern states, 224 on the Atlantic southeastern states, 164 along the Gulf of Mexico, 299 along the West Coast exclusive of Alaska, and 238 in the Great Lakes states (including New York's Great Lakes counties). Maine and Georgia, the states with the next lowest coastal population density, had 60 persons per square mile (Crossett et al. 2004). Crossett et al. project continued population growth in Alaska's coastal regions; however growth in these areas will never approach the levels seen in the lower 48 states.

Shipping routes from Pacific Northwest ports to Asia run across the GOA and through the BSAI, and pass near or through important fishing areas. The key transportation route from West Coast ports in

Washington, Oregon, and British Columbia to East Asia (and back) passes from the GOA into the EBS at Unimak Pass, and then returns to the Pacific Ocean in the area of Buldir Island. A minimum estimate is that 2,700 large vessels use this route each year. This estimate is based on estimates of vessels transiting Unimak Pass provided by the U.S. Coast Guard maritime Domain Awareness Center in 2004. More recent information suggests that the actual number of vessels transiting the Pass may be two or three times as large as this. (T. Robertson, pers. comm.). The direct routes from California ports to East Asia pass just south of the Aleutian Islands. Continued globalization, growth of the Chinese economy, and associated growth in other parts of the Far East may lead to increasing volumes of commercial cargo vessel traffic through Alaskan waters. U.S. agricultural exports to China, for example, doubled between 2002 and 2004; 41 percent of the increase, by value, was soybeans and 13 percent was wheat (USDA 2005, pp. 2-4). In future years, this may be an important route for Canadian oil exports to China (Zweig and Jianhai 2005).

The significance of this traffic for the regional environment and for fisheries was highlighted by the December 2004 grounding of the M/V Selendang Ayu and the M/V Cougar Ace accident in July 2006. The accident dumped the vessel's cargo of soybeans and as much as 320,000 gallons of bunker oil on the shores of Unalaska Island (USCG 2005).

Mining activities in Alaska are expected to increase in the coming years. In southeast Alaska, the Kensington Mine in Berners Bay is under construction and the Goldbelt Mine at Hawk Inlet is slated for expansion. The Red Dog Mine in northwest Alaska will continue operations and a new deposit in the Bristol Bay region is being explored for possible large-scale strip mining. The continued development and/or expansion of mines, though expected, will be dependent on stable metals prices in the coming years. At present it appears such prices will be stable.

Oil and gas development can also be expected to increase due to the currently high oil and gasoline prices. Plans are underway for development of a gas pipeline that may include a shipping segment through the GOA. Exploration and eventual extraction development of the Arctic National Wildlife Preserve is also anticipated. It is also possible that fuel prices may create incentive for oil and gas lease sales on the continental shelf off western Alaska, which is the prime fishing ground of the EBS.

On a National level, NMFS is working towards well-managed, environmentally-sound, and productive marine aquaculture operations by developing new offshore aquaculture legislation for the EEZ. NMFS plans to develop this legislation over the next five years to establish a fully operational regulatory infrastructure for offshore aquaculture that includes a streamlined permitting process, citing criteria, and pre-approved zones for offshore aquaculture (NMFS 2005a). With this National priority for aquaculture development, it is reasonably foreseeable that aquaculture will increase in the United States within the 10-year time frame, although probably not off Alaska.

In the near future, sablefish is the groundfish species most likely to become an aquaculture product. The relatively high value of sablefish has prompted research and development into sablefish aquaculture. If sablefish aquaculture becomes commercially viable, increased sablefish supply could cause a drop in sablefish prices as salmon aquaculture has impacted wild salmon prices. Available research indicates that sablefish aquaculture production of 30,000 mt, which is similar to current world wild production, would reduce sablefish ex-vessel prices by 37 percent (Huppert and Best 2004). Such a change would have direct impact on revenue earned by sablefish harvesters and may reduce effort in wild sablefish fisheries. This might reduce the benefits from IFQ and CDQ sablefish programs. In addition, the aquaculture industry could create environmental externalities from parasites, disease, escape, and pollution. A recent study by the Fisheries Center of the University of British Columbia concluded that, when the environmental externalities are considered, large-scale sablefish aquaculture would not be beneficial to the British Columbia economy (Sumalia et al. 2005).

Currently NMFS is unaware of plans for sablefish, or other finfish, aquaculture in Federal waters off of Alaska. The State of Alaska encourages shellfish aquaculture, but prohibits finfish aquaculture (K. Miller, pers. comm., December 16, 2005). Therefore, while price impacts could have an indirect environmental impact in the action area, by reducing incentives to fish for some species of groundfish, there appears to be little likelihood of a more direct environmental impact.

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Chapter 13 Environmental Justice Considerations

This section contains analyses required under Executive Order (E.O.) 12898, Environmental Justice (59 FR 7629). Under this E.O., demographic information is used to determine whether minority populations or low-income populations are present in the area affected by the proposed action. If so, a determination must be made as to whether the implementation of the proposed action may cause disproportionately high and adverse human health or environmental impacts on those populations. The disproportionality of the adverse impact to identified minority or low-income populations is the key factor under environmental justice analysis. Adverse impacts that affect the wider population as a whole are not considered potential environmental justice impacts.

As under NEPA itself, "environmental" effects under E.O. 12898 are construed to encompass social and economic effects, and these are discussed in some detail in this section. Human health effects, as mentioned in E.O. 12898, appear to be less relevant to impacts potentially associated with the various groundfish fishery management alternatives being considered in this document.[25]

13.1 Environmental Justice Existing Conditions

The question as to whether a proposed alternative raises environmental justice issues depends to a large degree on the history or circumstances of a particular population, as well as the specific ties of that population to the resources (or access to resources) that will be changed by the alternative. This section presents information on the approach used in this analysis, the demographic attributes of the communities and regions involved in the groundfish fishery, and other environmental justice issues and the populations associated with those potential issues.

[25] E.O. 12898 does include language regarding the need to identify differential patterns of subsistence consumption of fish and wildlife, but it goes on to link this data collection with potential human health risks associated with the consumption of pollutant-bearing fish and wildlife. While subsistence in Alaska is associated more strongly with minority (Alaska Native) populations and low-income populations (those in rural areas with fewer commercial economic opportunities) than other populations, there is no indication that any of the alternatives being considered would result in a degradation of resources in a manner such that their consumption would result in a health risk elevated above existing conditions.

13.1.1 Approach

There is no standardized methodology for identification or analysis of environmental justice issues. In determining what constitutes a minority "population," CEQ guidance states, "the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis." While no available federal guidance addresses the identification of low-income populations, a similar approach has generally been adopted when preparing NEPA documents (King 2001). The U.S. Environmental Protection Agency (EPA) has stated that addressing environmental justice concerns is entirely consistent with NEPA and that disproportionately high and adverse human health or environmental effects on minority or low-income populations should be analyzed with the same tools currently intrinsic to the NEPA process. NOAA environmental review procedures[26] state that, unlike NEPA, the trigger for analysis under E.O. 12898 is not limited to actions that are major or significant, and hence federal agencies are mandated to identify and address, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

It is important to note the meaning of the term "population" as it is typically applied to environmental justice analyses, as well as how it has been applied in the context of Alaska fisheries in particular. While a "population" can mean a geographically localized set of people (for example, residents of a village, town, or other spatially bounded community), a "population" could equally refer to a widely distributed set of people with a uniting or common set of circumstances, livelihoods, or lifeways that may be affected by the management alternatives. These could be very localized populations nodes (e.g., "population pockets" of workers living in group quarters at a series of processing plants in communities directly participating in the relevant fisheries) or they could be spread over very wide areas in a distribution pattern more closely resembling the total set of communities in a given region (e.g., residents of communities hundreds of miles removed from direct fisheries activities but that may nevertheless be affected by changes in access to subsistence resources that are themselves affected by the management action). Defining populations for environmental justice analysis of the groundfish fishery itself is particularly challenging as the fishery literally spans an area offshore of thousands of miles of coastline that encompasses dozens of communities in Alaska, including many communities with high Alaska Native (i.e., minority) population percentages, as well as encompassing large numbers of participants from the Pacific Northwest.

Fortunately for the purposes of this analysis, a substantial body of information on this subject already exists from previous work. The structure of the existing conditions discussion below, as well as the subsequent analysis of alternatives discussion, draws directly and heavily from a number of recent, relevant studies concerning fishery and wildlife management in Alaska, including the Alaska Groundfish Fisheries PSEIS (NMFS 2004a), Steller Sea Lion Protection Measures SEIS (NMFS 2001), Essential Fish Habitat EIS (NMFS 2005), and BSAI Crab Fisheries EIS (NMFS 2004b). No additional fieldwork was completed for this document.

These previous studies have laid out geographic groupings of communities and identified a number of issues and populations relevant to environmental justice analysis of groundfish fishery management actions. For example, the Alaska Groundfish Fisheries PSEIS aggregates community geographies into four regions in Alaska and two in the Pacific Northwest to encompass the full range of direct fishery participants. These are the Alaska Peninsula/Aleutian Islands region (which also encompasses the Pribilof Islands), the Kodiak Island region, the Southcentral Alaska region, the Southeast Alaska region, the Washington Inland Waters region, and the Oregon Coast region. This regional grouping is followed

[26] NOAA *Environmental Review Procedures for Implementing the National Environmental Policy Act* (Issued 06/03/99).

in this analysis to the extent it is relevant to environmental justice concerns. Beyond direct participation geographies, these previous studies also identified a number of key environmental justice issues to be examined, each of which has its own associated population(s) that are geographically distributed in a manner that may or may not overlap with the six regions noted. For example, western Alaska communities on the Bering Sea north of the Alaska Peninsula/Aleutian Islands region are primarily engaged in federal commercial groundfish fisheries through the CDQ program (and the existing conditions setting of the coastal/insular western Alaska region is discussed under that issue area). In addition to CDQ-related issues, other key issues include the environmental justice consequences of potential impacts to other Native Alaska entities/communities that have received direct groundfish allocations (the Aleut Corporation/community of Adak) as well as impacts to several subsistence-engaged or subsistence-reliant populations, specifically with regard to marine mammal subsistence (for those species, especially Steller sea lions and northern fur seals, that may be fishery affected), salmon subsistence (for those species and geographies that may be reliant on stocks affected by groundfish fishery PSC), and joint production efforts (where commercial vessels and gear that may be affected by the management alternatives are also used for subsistence pursuits), among others. The existing conditions for each of these potential issue areas are summarized in separate subsections below.

In addition to these earlier studies that are directly drawn upon for this analysis, another important source of relevant background data is found within the recently completed NOAA Technical Memorandum (Sepez et al. 2005). The report details a total of 136 coastal Alaskan fishing communities, and represents the most recent comprehensive source of detailed information on the community level, including currently available demographic information relevant to environment justice considerations.

13.1.2 Geographic and Demographic Variation

The population structure of the communities and regions engaged in the groundfish fisheries of the BSAI and GOA management areas varies considerably. For example, the PSEIS indicated that, within Alaska, and particularly in the Alaska Peninsula/Aleutian Islands region and the Kodiak Island region, there is a general community-level relationship between the percentage of Alaska Native population and commercial fisheries development. Specifically, communities that have developed as large commercial fishing communities have become less predominately Alaska Native in their population composition over time compared to other communities in the region. There are many variables involved, but in most communities examined the relationship is quite straightforward. While this type of direct impact on population structure attributable to groundfish is seen in few communities, these tend to be the communities with the highest level of groundfish-related processing activities and the highest engagement in, and dependence upon, the fishery. This varies considerably from place to place and is not apparent in the Southcentral and Southeast Alaska regions in the same way it is in the Alaska Peninsula/Aleutian Islands and Kodiak Island regions.

Interpretation of the available data, in terms of engagement with the community, is less straightforward for some regions than for others. As detailed in regional discussions, and in the community profiles referenced above (Sepez et al. 2005), communities are engaged in, and dependent upon, the fishery in distinctly different ways – through resident catcher vessel fleets, onshore processing facilities, and locally associated catcher/processor (and/or mothership) entities along with support service sector and other associated private and public sector activities. In some Alaska groundfish communities, processing plants tend to be industrial enclaves somewhat separate from the rest of the community, while for others there is no apparent differentiation between the processing workforce and the rest of the regional or local labor pool. For the purposes of this environmental justice analysis, however, these populations will be characterized as being resident in their residential workplace communities, consistent with U.S. Census methodology.

Further, available guidance for the implementation of E.O. 12898 recommends the use of U.S. Census data, and the methodology of the census (i.e., where all persons are counted) argues strongly for the inclusion of relatively short-term residents, including foreign nationals, in the environmental justice analysis. As noted by the EPA, however, census data alone may not always prove sufficient for a thorough analysis, "in part because the level of aggregation may not offer a fine enough mesh to identify the existence of minority and/or low-income populations." In the Alaska Groundfish PSEIS, industry provided data were used to identify such "pockets" of minority populations within various groundfish communities that are relevant to the analysis of the proposed alternatives. These data are self-reported and, like other self-reported data, there may be an inherent self-interest bias to at least some degree found within the information. Whatever bias exists, however, is considered likely to be relatively small and not sufficient to materially alter the overall assessment of whether the local seafood processing workforce represents a population segment that is "meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographical analysis" such as the specific community or region.

13.1.3 General Environmental Justice Population Attributes by Region

Alaska Peninsula/Aleutian Islands Region

General Community Population Attributes

Previous studies have indicated that the Alaska communities with the strongest engagement in the North Pacific groundfish fishery are Unalaska, Akutan, Sand Point, and King Cove.[27] These four communities and their specific ties to the groundfish fishery were detailed in the PSEIS (NMFS 2004a). In this section, existing community level information relevant to environmental justice is summarized.[28]

These communities vary widely in their population structure. For example, Unalaska is the largest community but has the lowest Alaska Native population percentage, and King Cove and Sand Point have a much higher Alaska Native population component than either of the other two communities. While Akutan has a relatively low Alaska Native population percentage, the Alaska Native population is highly concentrated in one area and generally insulated from commercial groundfish-related activity and its associated non-Native population. Thus, the Alaska Native portion of the community at least in some ways bears the most resemblance to "village life" from an earlier era among the four communities.

As shown in Table 13-1 below, Unalaska has a far higher white or non-minority population percentage than the other three communities. Asian residents represent the largest population segment in Akutan, and the second largest in Unalaska (behind whites) and in King Cove (behind Alaska Natives), and the

[27] As noted in Alaska Groundfish Fisheries PSEIS (NMFS 2004a) there are also ties between the fishery to Adak, Chignik, False Pass, and St. Paul. However, these ties are far less pervasive and do not have the historical depth of the ties seen in Unalaska, Akutan, Sand Point, and King Cove. Due to these differences in existing conditions, the communities of Adak, Chignik, False Pass, and St. Paul are not detailed in this section, but each may experience impacts resulting from management actions under the various alternatives, if not to the degree seen in Unalaska, Akutan, Sand Point, and King Cove.

[28] As noted above, this region also encompasses the Pribilof Island communities (St. George and St. Paul). While not having the same degree of direct engagement with the groundfish fisheries as the other communities specifically noted in this section, the Pribilof communities may experience impacts associated with groundfish management actions in a number of ways, as discussed in subsequent sections on impacts to CDQ communities and marine mammal-based subsistence. Existing conditions relevant to environmental justice analysis for these communities are discussed in more detail in those sections below.

third largest in Sand Point (behind Alaska Natives and whites). These communities have quite different histories with respect to the growth of the different population segments present in the community in 2000.

Table 13-1 Racial and Ethnic Composition of Population, Selected Alaska Peninsula/Aleutian Islands Region Communities, 2000

Race/Ethnicity	Unalaska		Akutan		King Cove		Sand Point	
	N	%	N	%	N	%	N	%
White	1,893	44.2	168	23.6	119	15.0	264	27.7
Black or African American	157	3.7	15	2.2	13	1.6	14	1.5
Native American/Alaska Native	330	7.7	112	15.7	370	46.7	403	42.3
Nat. Hawaiian/Other Pacific Islander	24	0.6	2	0.3	1	0.1	3	0.3
Asian	1,312	30.6	275	38.6	212	26.8	221	23.2
Some Other Race	399	9.3	130	18.2	47	5.9	21	2.2
Two Or More Races	168	3.9	11	1.5	30	3.8	26	2.7
Total	4,283	100	713	100	792	100	952	100
Hispanic*	551	12.9	148	20.8	59	7.4	129	13.6

* "Hispanic" is an ethnic category and may include individuals of any race (and therefore is not included in the total as this would result in double counting).
Source: U.S. Bureau of Census.

One important constant across all of these communities is that each is a minority community in the sense that minorities make up a majority of the population in each community. Unalaska may be described as a plural or complex community in terms of the ethnic composition of its population. Although Unalaska was traditionally an Aleut community, the ethnic composition has changed with people moving into the community on both a short-term and long-term basis.

Akutan is a unique community in terms of its relationship to the Bering Sea groundfish fishery. It is the site of one of the largest shore plants in the region, but it is also the site of a village that is geographically and socially distinct from the shore plant. This duality of structure has had marked consequences for the relationship of Akutan to the fishery[29] and in turn highlights the fundamentally different nature of Akutan and Unalaska. Akutan, while deriving economic benefits from the presence of a large shore plant near the community proper, has not articulated large-scale commercial fishing activity with the daily life of the community as has Unalaska, nor has it developed the type of support economy that is a central part of the socioeconomic structure of Unalaska.

[29] One example of this may be found in Akutan's status as a CDQ community. Initially (in 1992), Akutan was (along with Unalaska) deemed not eligible for participation in the CDQ program because the community was home to "previously developed harvesting or processing capability sufficient to support substantial groundfish participation in the BSAI …," though they met all other qualifying criteria. The Akutan Traditional Council initiated action to show that the community of Akutan, per se, was separate and distinct from the seafood processing plant some distance away from the residential community site, that interactions between the community and the plant were of a limited nature, and that the plant was not incorporated in the fabric of the community such that little opportunity existed for Akutan residents to participate meaningfully in the Bering Sea pollock fishery. That is, it was argued that the plant was essentially an industrial enclave or worksite separate and distinct from the traditional community of Akutan and that few, if any, Akutan residents worked at the plant). With the support of the APICDA and others, Akutan was successful in a subsequent attempt to become a CDQ community and obtained CDQ status in 1996.

While U.S. Census figures show Akutan had a population of 589 in 1990 and 713 in 2000, the Traditional Council considers the local resident population of the community to be around 80 persons, with the balance being considered non-resident employees of the seafood plant. This definition obviously differs from census, state, and electoral definitions of residency but is reflective of the social reality of Akutan. The residents of the village of Akutan, proper, are almost all Aleut.

Sand Point and King Cove share a more or less common development history, but one quite different from either Unalaska or Akutan.[30] Historically, both of these communities saw a large influx of non-resident fish tenders, seafood processing workers, fishers, and crew members each summer. For the last several decades, both communities were primarily involved in the commercial salmon fisheries of the area, but with the decline of the salmon fishery, plants in both communities have diversified into other species. In more recent years, the processing plants in both communities have become heavily involved in the groundfish fishery.[31]

Table 13-2 displays data on employment, income, and poverty[32] information for the relevant communities for 2000. The income range is large for the communities shown, with the median family income in Akutan being roughly half of that in Unalaska.

Table13-2 Employment, Income, and Poverty Information, Selected Alaska Peninsula/ Aleutian Islands Region Communities, 2000

Community	Total Persons Employed	Unemployed	Percent Unemployment	Percent Adults Not Working	Not Seeking Employment	Percent Poverty	Median Family Income
Akutan	97	505	78.9	84.84	38	45.5	$43,125
King Cove	450	31	4.7	31.50	176	11.9	$47,188
Sand Point	427	190	22.8	48.67	215	16.0	$58,000
Unalaska	2,675	414	11.1	27.93	625	12.5	$80,829

Source: U.S. Bureau of the Census 2000.

The contrast between these and the other communities is reflective of both lack of economic development in these communities and the nature of the workforce population in communities with shore plants, where

[30] Sand Point was founded in 1898 by a San Francisco fishing company as a trading post and cod fishing station. Aleuts from surrounding villages and Scandinavian fishermen were the first residents of the community. King Cove was founded in 1911 when Pacific American Fisheries built a salmon cannery. Early settlers were mostly Scandinavian, European, and Aleut fishermen and their families.

[31] Their structural relationships to the fishery have diverged since the passage of the AFA. Processing facilities in both communities qualified as AFA entities; however, King Cove qualified for a locally based catcher vessel co-op while Sand Point did not.

[32] Poverty figures in this section are based on U.S. Census information which, in turn, is based on the Federal government's official poverty definition. Families and persons are classified as below poverty if their total family income or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of related children under age 18 present. The poverty thresholds are the same for all parts of the country and are not adjusted for regional, state, or local variations in the cost of living. The poverty thresholds are updated every year to reflect changes in the Consumer Price Index.

large numbers of processing workers are present, tend not to have non-working adult family members present with them, and tend to be in the community exclusively for employment purposes.[33]

Population Attributes of the Resident Groundfish Fishery Workforce

Beyond the overall population, income, and employment figures for the individual communities, it is important for the purposes of environmental justice analysis to examine information on the residential groundfish fishery workforces. It is likely that employment and income losses or gains associated with at least some of the proposed alternatives would be felt among the local seafood processing workers, and these workers do not comprise a representative cross section of the community demography.

Census Data

One method to examine the relative demographic composition of the local processing workforces is to use group quarters housing data from the U.S. Census (keeping with the established practice of using U.S. Census data for environmental justice analysis). The group ethnicity-by-housing type data drawn from the 1990 census and the 2000 census (as well as subsequent sections augmenting this information with industry-provided figures for 2000) was discussed in detail in the PSEIS and is summarized here.

Group housing in Unalaska is largely associated with the processing workforce. A majority of the population lived in group housing as of 1990 and the total minority population proportion was substantially higher in group quarters than in non-group quarters. The 2000 figures showed a similar overall split between group quarters and non-group quarters populations, but the minority population distribution between and within housing types changed substantially in the 1990 to 2000 period. Although demographic categories changed somewhat between the 1990 and 2000 census, some relatively large changes are readily apparent. For example, in 1990, the "Asian or Pacific Islander" category accounted for 27 percent of group quarters population, and 42 percent by 2000.

In general, in 2000 Unalaska had a substantially greater minority population in absolute and relative terms than it did in 1990, and this is readily apparent within the group quarters population that is largely associated with seafood processing workers. In other words, environmental justice is potentially a large concern if there is the potential for processing worker displacement, and one that has grown through time.

Group housing in Akutan is almost exclusively associated with the processing workforce. As of 2000, a total 89 percent of the population lived in group housing, which represents the extreme of the four communities considered in this region. In 2000, the racial and ethnic composition of the group and non-group housing segments were markedly different, with the non-group housing population being predominately Alaska Native (87 percent), and the group housing population having little Alaska Native/Native American representation (7 percent). Like Unalaska, overall minority population

[33] Additionally, Table 13-2 illustrates a potentially problematic aspect of the 2000 data. As shown in the PSEIS, in 1990 there was virtually no unemployment in these communities, no doubt due in large to the presence of fishery-related employment opportunities. A working knowledge of the fishing industry would seem to indicate the 2000 data are anomalous. For example, in 2000 the U.S. Census lists a total of 505 unemployed persons in Akutan. Given that the traditional village of Akutan consists of less than 100 persons (including all age groups, not just adults in the labor pool who could qualify as employed or unemployed), the overwhelming majority of persons enumerated as unemployed must have been idled seafood processing workers. While this unemployment may have been real in the sense that processing workers were present and not actively working when the census was taken, it is most likely an artifact of the timing of the census. Processing workers are not typically present in the community when the plant is idle for any extended period of time. Under normal conditions, there are no unemployed seafood processing workers present in the community (by design). The same type of data problem may be occurring in Sand Point and Unalaska, but this is not as clear as is the case for Akutan.

representation was higher in absolute and relative terms in the community as a whole and in both group and non-group quarters in 2000 than in 1990.

As with the other communities, group housing in King Cove is largely associated with the processing workforce (38 percent of the population in 2000). The distribution of ethnicity between housing types is striking. In 2000, the Alaska Natives/Native Americans comprised 75 percent of the non-group quarters population in the community; there was only one Alaska Native/Native American individual living in group quarters in the community. The "Asian" group comprised over 64 percent of the group quarters population in 2000, having risen substantially from 1990.

The white component of the population of King Cove was smaller in absolute and relative terms in 2000 than in 1990 for the community as a whole and in group quarters. Among non-group quarters residents, the number of white residents was larger in 2000 than in 1990 but still represented a smaller proportion of the non-group quarters population in 2000 than in 1990. In other words, environmental justice is clearly an issue of potential concern for the community as a whole and for the seafood processing-associated group quarters population in particular, and census counts suggest that minority representation has substantially increased over the period 1990 to 2000.

In Sand Point as of 2000, 36 percent of the population lived in group housing, which was only slightly less than the King Cove figure for that same year. In 2000, no Alaska Natives/Native Americans lived in group quarters in the community, but they comprised 66 percent of the population living outside of group quarters. As shown, the ethnic and racial diversity among group quarters residents was, in general, substantially less in 2000 than in 1990. Asians comprised over 60 percent of all persons living in group quarters in 2000 with persons of Hispanic origin accounting for about two-thirds of the remaining 40 percent of group quarters residents.

Industry -Provided Data

Information on 2000 workforce demographics was obtained for four of the six major groundfish shore plants in the Alaska Peninsula/Aleutian Islands region, as well as one of the two floating processors that are classified as inshore plants. At least some of the entities voluntarily providing these data consider them confidential or proprietary business information, but they agreed to provide the information if it was aggregated with data supplied by others such that details about individual operations were not disclosed. As a result of these concerns, communities cannot be discussed individually.

It can be stated that the total combined reported processing (and administrative) workforce of 2,364 persons was classified as 22.5 percent white or non-minority, and 77.5 percent minority. Reporting shore plants ranged from having a three-quarters minority workforce to an over 90 percent minority workforce. It is worth noting that different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce. For some plants, the total minority figure was not disaggregated, and too few plants within this region provided detailed data to allow region-specific discussion.

In general, however, all of the shore plants in this region that provided detailed data have workforces that are 5 percent or less Black or African American and 5 percent or less Alaska Native/Native American (a pattern also seen in the detailed data from Kodiak plants). More variability was seen among other minority population components. The group classified as Asian/Pacific Islander was the largest minority group in two-thirds of the plants in any region reporting detailed data, and the group classified as Hispanic was the largest minority group in the remaining one-third. Two entities provided time series data. One provided data spanning a 10-year period, while the other provided information covering a

4-year span. For the former, the minority workforce component increased over time; for the latter, no unidirectional trend existed.

Regional Summary

The communities in the region that are most engaged in, and dependent upon, the groundfish fishery are those with populations composed of more minority residents than non-minority residents. The structure of the minority population component varies from community to community, as does the proportion of the community population that is composed of Alaska Native residents. Further, the workforce at the processing plants that would likely feel the impacts of the alternatives is overwhelmingly composed of minority workers.

Kodiak Island Region

General Community Population Attributes

Within the Kodiak region, the City of Kodiak is the location of virtually all of the direct links with the groundfish fishery. Given these circumstances, it will be the only regional community discussed in detail. The Alaskan Native population has remained at approximately the same percentage since the 1970s, but the white (non-minority) population has declined in terms of percentage over time. Overall, there has thus been a gradual, long-term shift in ethnic composition, with Asian and Pacific Islanders increasing in percentage. Census data from 2000 detailing ethnicity are presented in Table 13-3. As shown, the majority of Kodiak's population is composed of minority residents.

Table 13-3 Ethnic Composition of City of Kodiak Population, 2000

Race/Ethnicity	**2000**	
	N	**%**
White	2,939	46.4
Black or African American	44	0.7
Native American/Alaska Native	663	10.5
Native Hawaiian/Other Pacific Islander	59	0.9
Asian	2,010	31.7
Some Other Race	276	4.3
Two or More Races	343	5.4
Total	6,334	100
Hispanic*	541	8.5

* "Hispanic" is an ethnic category and may include individuals of any race (and therefore is not included in the total as this would result in double counting).

Source: U.S. Bureau of Census.

Table 13-4 presents information on income, employment, and poverty for the City of Kodiak and the Kodiak Island Borough is based on 2000 U.S. Census data. As shown, the City of Kodiak is above the borough income averages. For example, median family income in Kodiak itself is about 3 percent higher than the borough as a whole.

Table 13-4 Employment, Income, and Poverty Information, Selected Kodiak Region Communities, 2000

Community	Total Persons Employed	Unemployed	Percent Unemployment	Percent Adults not Working	Not Seeking Employment	Percent Poverty	Median Family Income
Kodiak	3,053	160	3.6	29.62	1,170	7.4	$60,484
Kodiak Island Borough	6,131	335	3.4	29.27	2,532	6.6	$58,834

Source: U.S. Bureau of Census.

There was very little unemployment in these jurisdictions, presumably due in part to the presence of fishery-related employment opportunities, and also because the Kodiak economy is relatively diversified by rural Alaska standards (and particularly in comparison to the Aleutian region communities). The City of Kodiak had the second-lowest unemployment of any civilian community in the region (3.6 percent compared to 2.1 percent in Port Lions), whereas the village of Old Harbor had the highest unemployment in the region at 12.5 percent.

Population Attributes of the Resident Groundfish Fishery Workforce

Census Data

Group housing in the community is largely associated with the processing workforce, but not to the nearly exclusive degree seen in the Aleutian communities. The institutional base and range of housing types in Kodiak are more complex. Only 6 percent of the population lived in group housing in 1990, and only about 2 percent in 2000 (U.S. Bureau of the Census 2001). This is a much lower percentage of the population residing in group quarters than in the other communities profiled. This is consistent with a processing workforce more heavily drawn from the local labor pool. In 2000, there was a significant difference between the group quarters and non-group quarters demographics (with the group quarters population being a higher minority group than the community population as a whole); the differences were not as sharp in general or for particular groups as seen in the Aleutian region communities. The small numbers of persons involved, however, make conclusions about the proportionality or trends of change between groups somewhat tenuous.

Industry Provided Data

Given the nature of the relationship between the processing workforce and the local communities, industry information comparable to that of the Aleutians region was not systematically collected from Kodiak region entities. The information received was not sufficient to disclose precise community level information due to confidentiality concerns. As a generality, the 2000 data received indicated that at least some shore plants in this region have workforces with a greater minority population component than the Aleutian regional average (77.5 percent). This is despite the fact that, generally, the Kodiak processing workforce is drawn to a larger degree from a local labor pool than is the case for the Aleutian communities.

As for the Aleutian region, different firms provided different levels of detail in the breakout of the internal composition of the minority component of their workforce. For some plants, the total minority figure was not disaggregated, and not enough plants within this region provided detailed data to allow region-specific discussion. However, as mentioned in the Aleutian region discussion, all of the shore plants in any region that provided detailed data have workforces 5 percent or less Black or African American and 5 percent or less Alaska Native/Native American. For the Kodiak region, the group classified as Asian/Pacific Islander was the largest minority group noted within the limited detailed data received.

Regional Summary

Kodiak, the community in the region that is most engaged in and dependent upon the groundfish fishery, is composed of more minority residents than non-minority residents. While systematic data do not exist, the data that are available suggest that the workforce at the processing plants that would likely feel the impacts of the alternatives is primarily composed of minority workers.

Southcentral and Southeast Alaska Regions

Environmental justice is likely to be much less of an issue in the southcentral and southeast Alaska region communities than in the Alaska Peninsula/Aleutian Islands and Kodiak Island regions, for several reasons. Of primary importance among these is the nature of the communities most directly engaged in the commercial groundfish fishery. As described in the PSEIS (NMFS 2004a), the communities most engaged in the groundfish fishery in southcentral Alaska, particularly with respect to the processing sector, are largely non-Native communities and have relatively large populations and diversified economic opportunities, especially compared to the Alaska Peninsula/Aleutian Islands groundfish communities.

The same holds true for the southeast Alaska region, with the exception of Yakutat. A second factor is the relatively low level of processing employment directly attributable to groundfish in these regions that could potentially be at risk under at least some of the groundfish management alternatives. For example, in 2001, there were only an estimated 106 full-time equivalent (FTE) groundfish processing jobs among all of the communities in the entire southeast Alaska region (or about 33 times fewer groundfish processing FTEs than in the Alaska Peninsula/Aleutian Islands region). While the potential loss of these positions would, of course, be of consequence for the individuals and operations involved, the diversity of processing operations, size and diversity of community populations, and availability of alternative economic opportunities would serve to dampen the environmental justice dimension of any impacts realized at the community or regional level.

Similarly, in 2001 among all of the communities in the southcentral Alaska region, there were an estimated 150 groundfish processing FTEs, or about one-quarter the number found in Kodiak alone. These community and workforce factors, especially in combination, mean that, in general, the types of environmental justice concerns seen in the Alaska Peninsula/Aleutian Islands and Kodiak Island regions are largely absent in the southcentral and southeast regions. Further, environmental justice concerns linked to Steller sea lion and salmon subsistence activities are also largely absent in these two regions. As a result, detailed environmental justice existing conditions information has not been developed for these regions. The regional data presented in the PSEIS (NMFS 2004a) are considered sufficient for analytical needs.

Washington Inland Waters and Oregon Coast Regions

The greater Seattle area is the center for much of the economic activity related to the North Pacific groundfish fishery. However, the geographic footprint of those activities is difficult to define, and it cannot be attributed to specific communities or neighborhoods in the same manner as Alaska communities may be linked to the fishery, as discussed in the PSEIS (NMFS 2004a). Given the nature of engagement with the fishery, the Washington Inland Waters region does not have the same type of resident workforce focused in individual communities in a manner comparable to that seen in Alaska communities. Also, unlike the Alaska groundfish communities, the white portion of the population comprises a large majority of the overall population (i.e., racial or ethnic groups classified as minorities are mathematical minorities within the local overall population, unlike the relevant Alaska communities).

For these reasons, environmental justice is not considered a regional or community level issue for North Pacific groundfish management initiatives for the greater Seattle area, or the Washington Inland Waters region as a whole. Although quantitative data are not available to confirm this, based on interview data it does not appear to be an issue for the regionally based catcher vessel fleet either. As there are no Alaska groundfish shore-based processing entities in this region, the types of environmental justice issues associated with these workforces seen in some of the Alaska regions are not present in the Washington Inland Waters region. While it is possible that catcher/processor vessel workforces may have similar issues, no data are available to confirm this.

There is no indication from available information that environmental justice will be an issue in the Oregon Coast region. No plants processing North Pacific groundfish operate in this region, nor are any owned by residents of this region, so populations associated with this sector are not a concern. As detailed in the PSEIS (NMFS 2004a), this region is engaged in the Alaska groundfish fishery primarily through the catcher vessel sector. While demographic data on catcher vessel owners and crews are not available, discussions with industry sources and familiarity with the fishery indicate that this group is not disproportionately composed of individuals from minority populations.

13.1.4 Other Environmental Justice Issues: Community Development Quota Regions, Aleutian Islands Pollock Allocations, and Subsistence Concerns

Three other main issue areas discussed elsewhere in this (and other) documents are central to environmental justice considerations. For reasons noted below, impacts to the CDQ program and its associated communities, impacts to Aleutian Islands pollock allocations (designed to benefit the community of Adak via the Aleut Corporation), and impacts to subsistence (and the relevant associated communities) may be associated with environmental justice concerns.

CDQ Region/Communities

The CDQ region presents a different type of environmental justice context. While it is close to some of the most productive fishing grounds in the world, the region of western Alaska encompassing communities bordering the Bering Sea is one of the most economically depressed regions of the United States. In 1992, the CDQ program was developed to facilitate the participation of many western Alaska communities in the BSAI fisheries off their shores, as a means to develop a local community infrastructure and increase general community and individual economic and social well-being.

A total of 65 communities within a 50-mile radius of the Bering Sea met all of the qualifications and continue to participate in the program through a total of 6 CDQ groups.[34] Geographically dispersed, they extend westward to Atka, on the Aleutian Island chain, and northward along the Bering coast to the

[34] The CDQ groups include the Aleutian Pribilof Island Community Development Association, the Bristol Bay Economic Development Corporation, the Central Bering Sea Fishermen's Association, the Coastal Villages Region Fund, the Norton Sound Economic Development Corporation, and the Yukon Delta Fisheries Development Association.

village of Wales, near the Arctic Circle. The 2000 population of these communities was just over 27,000 persons of whom approximately 87 percent were Alaska Native. In general economic terms, CDQ communities are remote, isolated settlements with few commercially valuable natural assets with which to develop and sustain a viable, diversified economic base. As a result, economic opportunities have been few, unemployment rates have been chronically high, and communities (and the region) have been economically depressed. Given the substantial minority population and low-income population components of the total population of this area, the western Alaska region within the CDQ program area contains a population for whom adverse fishery management-related impacts would logically trigger environmental justice concerns.

The very high capital investment required to compete in federal BSAI groundfish fisheries has generally precluded small communities in this region from participating in their development. The CDQ program serves to ameliorate some of these circumstances by extending an opportunity to qualifying communities to directly benefit from the productive harvest and use of these publicly owned resources. The CDQ program was permanently institutionalized through the Magnuson-Stevens Act authorized by the U.S. Congress in 1996. Originally involving only the pollock fishery, the program has in recent years expanded to become multi-species in nature. Currently, the CDQ program is allocated portions of the groundfish fishery that range from 10 percent for pollock to 7.5 percent for most other species. As noted in the CDQ groups discussion, in addition to infrastructure development projects within the region, the CDQ program has contributed to fishing industry-related capital improvement projects, leading to important overall development impacts to the communities. Loan programs and investment opportunities for local fishermen have also been made available. As of 2004, the program provided 1,754 jobs for region residents with yearly wages exceeding $12.3 million.

Environmental justice issues are salient in this area due to the nature of the demographic and economic structure of the region, and the nature of the participation of this region and its communities in the fishery through various mechanisms of the CDQ program. The CDQ program was explicitly designed to foster fishery participation among, and to direct fishery benefits toward, minority (Native Alaskan) populations and low-income populations in the economically underdeveloped communities of the region. To the extent that the CDQ program has achieved these objectives, negative impacts to the CDQ program and communities are essentially, by definition, environmental justice impacts. The existing conditions in this region and the attributes of the program are discussed in detail in Section 12.14 of this document as well as in the BSAI Crab Fisheries EIS (NMFS 2004b), and the PSEIS (2004a).

Aleutian Islands Pollock Allocations (Aleut Corporation/Community of Adak)

Section 803 of the Consolidated Appropriations Act of 2004 (Public Law 108-199) established the Aleutian Islands-directed pollock fishery allocation to the Aleut Corporation for the purpose of economic development in the community of Adak. Since the implementation of this Act, the non-CDQ-directed pollock fishery in the Aleutian Islands management subarea has been fully allocated to the Aleut Corporation.

The Aleut Corporation was formed under the auspices of the Alaska Native Claims Settlement Act of 1971 as the Alaska Native regional corporation for the Aleutian/Pribilof Islands region. It remains an Alaska Native comprised entity, with its Alaska Native shareholders residing in the communities of the region and far beyond. As described in detail in the Adak community profile within the Social Impact Assessment included in the BSAI Crab Fisheries EIS (NMFS 2004b) and summarized in Sepez et al. (2005), although there were previous settlements on the island, Adak was a military community from the World War II era until the closure of the local installation in 1997. During and since the base closure process, the Aleut Corporation, directly and through a number of related corporate entities, has worked to reestablish a civilian-based community on Adak and to foster the economic development of that community for the benefit of Adak community residents and its shareholders. The contemporary civilian population of the community of Adak initially grew out of an outreach program to shareholders of the Aleut Corporation that encouraged and facilitated repopulation of the community. As of 2000, according to U.S. Census data, the population of the community was 316, of whom 35 percent were Alaska Native/Native American.

For the purposes of environmental justice analysis, the potentially affected population for any adverse impacts that may accrue to the Aleut Corporation/Adak fishery allocation would be considered to be the residents of the community of Adak as well as the shareholders of the Aleut Corporation, whatever their community of residence, inside or outside of the Aleutian/Pribilof Islands region. While the population of the community of Adak itself is not comprised of an Alaska Native majority, the overall affected population of the community and the Aleut Corporation combined would be considered a minority population. The Aleut Corporation has more than 3,000 shareholders, many of whom live in Anchorage and the Pacific Northwest in addition to communities within the Aleutian/Pribilof region itself (Stricker 2001).

Subsistence

Subsistence raises environmental justice issues. While not only Alaska Natives participate in subsistence activities, areas in which various subsistence activities are practiced that may be impacted by groundfish harvest strategy alternatives are predominately Alaska Native. Impacts to subsistence potentially qualify as environmental justice issues as a result of this disproportional Alaska Native (minority population) involvement.

For a number of the relevant communities, where commercial economic opportunities are limited and incomes are relatively low (i.e., low-income populations are involved in subsistence in some areas), subsistence is an important aspect of community economic life. Not only would an impact to subsistence potentially be a disproportionate impact to a low-income population, the impact would make a low-income population even worse off in economic terms than under existing conditions.

In general, the subsistence use of natural resources by Alaska Native peoples represents a set of relationships to the local environment and a continuity of use that stretches back to prehistoric times, despite changes in technology and society. Subsistence activities are a central element of contemporary village life that often involves myriad social and cultural elements and whose importance ranges from being a basic component of physical sustenance to a part of relationships involved with a sense of group identity and individual feelings of well-being. Among some groups, subsistence activities may be seen as a part of a web of spiritual or philosophical relationships between human populations and the rest of the natural world. Subsistence is also important to many of Alaska's non-Native residents, despite greater or lesser differences between groups in the specific cultural context of subsistence.

The geographic area of potential impact to subsistence (and therefore the communities potentially involved) varies by type of subsistence activity. A description of subsistence use of natural resources potentially affected by commercial groundfish fisheries was outlined in detail in the PSEIS (NMFS 2004a) and was usefully split into the following sections: groundfish; marine mammals (through indirect impacts to Steller sea lion and northern fur seal populations); subsistence reliant on those species classified as prohibited species in the groundfish fishery, especially salmon fishing (through salmon bycatch in the groundfish fishery primarily through at-sea bycatch interception of Chinook and chum salmon); and other subsistence activities including joint production and income-related impacts (through curtailment of the ability to effectively utilize commercial vessels or gear for subsistence purposes).

Groundfish

Subsistence use of groundfish resources in Alaska is described in Section 12.11 of this document and in detail in the PSEIS (NMFS 2004a). Groundfish subsistence occurs over a very large geographic area, but in general, subsistence groundfish use levels are low in comparison to use levels of subsistence resources overall, and in relation to other fish resources in particular. In general, groundfish are a relatively small part of subsistence consumption, ranging from close to zero up to about 9 percent of total resources consumed by weight, per capita, depending on the community and year. Commercial fisheries may target stocks, such as rockfish, that are also targeted by subsistence fishermen, but there is no indication that this dual use of stocks has resulted in detrimental impacts to groundfish subsistence utilization under existing conditions.

Marine Mammals

The subsistence take of marine mammals is restricted to the Alaska Native portion of the population under the terms of the Marine Mammal Protection Act of 1972 (as reauthorized in 1994 and amended through 1997; the specific exemption for Alaska Natives is found in Section 101 [16 USC 1371]). The Alaska Native exemption within the MMPA allows for Alaska Natives who dwell on the coast of the North Pacific Ocean or Arctic Ocean to take marine mammals for the purposes of subsistence (or for the purposes of creating and selling authentic native handicrafts and articles of clothing).

Harvests in comparison with PBR levels for marine mammals have been used to identify potentially serious adverse impacts of groundfish fishery takes. In situations where human induced mortality of species is close to the animal's PBR, stock declines may lead to downward adjustments in PBR levels, which would result in the PBR being exceeded under the current levels of mortality. Adjustments to mortality would then be considered, with reduction in subsistence harvests one possibility. Human induced mortality is close to PBR levels for two species: Steller sea lions and harbor seals. Groundfish fishery competition for marine mammal prey may be an important factor that could lead to reductions in PBR levels. Prey competition is considered for Steller sea lions and northern fur seals.

Steller sea lions are taken by a number of methods throughout the year. Unlike a number of other subsistence activities that are more broadly participatory, hunting for sea lions is a relatively specialized activity, and a relatively small core of highly productive hunters from a limited number of households account for most of the harvest. There has been some change in harvesting techniques in recent years, and there is also variation by region. Seasonality of sea lion harvest is quite variable and appears to be dependent on sea lion abundance and distribution.

Looking across regions, in 2003 approximately 51 percent of the total subsistence take of Steller sea lions occurred in the Aleutian Islands region, about 17 percent in the Kodiak Island region, about 15 percent in the Pribilof Island region, and about 12 percent in the North Pacific Rim region. The Southeast Alaska and South Alaska Peninsula regions accounted for about 3 and 2 percent, respectively, of the total subsistence take in 2003. In 2003 a total of 17 of the 62 surveyed communities reported harvesting sea lions, with 9 communities reporting takes of five or more sea lions. The seven top ranking communities were Atka (82 sea lions), Old Harbor (32 sea lions), St. Paul (18 sea lions), Unalaska (16 sea lions), St. George (14 sea lions), Tatitlek (14 sea lions), and Akutan (9 sea lions). These seven communities accounted for 185 sea lions, or 87 percent of the total Alaska subsistence take (Wolfe et al. 2004).

The number of individuals reporting hunting sea lions has declined substantially since the early 1990s. The estimated numbers of households that reported at least one member hunting sea lions were 199 (1992), 222 (1993), 210 (1994), 158 (1995), 130 (1996), 97 (1997), 111 (1998), 117 (2000), 98 (2001), 90 (2002), and 97 (2003). In general, declines in the numbers of sea lion hunters occurred at a time when sea lions became increasingly harder to find in local hunting areas and consequently more difficult and expensive to hunt. Rate of success, however, has not tracked in parallel with numbers of hunters or reported increases in time and effort necessary to hunt successfully. The proportion of unsuccessful hunting households for sea lions has been 30 percent (1992), 35 percent (1993), 40 percent (1994), 24 percent (1995), 35 percent (1996), 23 percent (1997), 33 percent (1998), 25 percent (2000), 21 percent (2001), 29 percent (2002), and 22 percent (2003) (Wolfe et al. 2004).

While the available information suggests some support for a direct relationship between the overall Steller sea lion population and the level of subsistence harvest, such support is not definitive and other factors cannot be excluded. Given the relatively small numbers involved, the concentrated efforts of a single hunter or just a few hunters can make relatively large percentage changes in community harvest totals. The weighting of factors is also not possible from the evidence available. It does appear that present Steller sea lion harvest methods are likely to be more successful, and certainly more efficient, when resource populations (and density) are higher. A number of factors may be at work, however, such that a recovery in Steller sea lion abundance may not necessarily result in a marked increase in subsistence take, but too little is known regarding the determinants of subsistence demand for Steller sea lions to reach any definitive conclusions.

On a community level, it is important to note that of all the communities identified in the text of the PSEIS (NMFS 2004a) as having a documented Steller sea lion harvest, only Akutan and Unalaska are identified as "regionally important groundfish communities" with substantial direct participation in the fishery. In other words, where use of Steller sea lions is identified as important to the community subsistence base, the commercial groundfish fishery is generally not, and vice versa.

The PSEIS notes that fifty years ago, the harbor seal was so abundant in Alaska (and perceived to be in conflict with commercial salmon fisheries) that the state issued a bounty for the animal. State-sponsored bounties and predator control programs, as well as commercial harvest of harbor seals, occurred on a regular basis throughout the animal's range until the passage of the MMPA. Both adult seals and pups were harvested for pelts. An estimated 3,000 seals, mostly pups, were harvested annually for their pelts along the Alaska Peninsula between 1963 and 1972, accounting for 50 percent of the pup production. (PSEIS 2004a, page 3.8-30)

The PSEIS goes on to note that harvest of harbor seals for subsistence purposes is likely the highest cause of anthropogenic mortality for this species since the cessation of commercial harvests in the early 1970s. Between 1992 and 1998, the statewide harvest of harbor seals from all stocks ranged between 2,546 and 2,854 animals, the majority of which were taken in southeast Alaska. Aside from their value as a food source, harbor seals play an important role in the culture of many Native Alaskan communities. (PSEIS 2004a, 3.8-30)

The PSEIS provides the following regional information about the relationship between human induced mortality and PBR. The Bering Sea stock of harbor seals is approximately 13,000 animals, and the calculated PBR is 379 animals. The annual subsistence harvest from this stock from 1994 to 1996 was approximately 161 animals, 42 percent of PBR for this species. In 1998, 178 harbor seals from this stock were taken in the subsistence harvest. For the GOA stock, the calculated PBR is 868 animals. The average annual subsistence harvest from the GOA between 1992 and 1996 was 791 animals, representing 91 percent of the PBR for this stock. The latest available harvest data from 1998 (792) is comparable to the average subsistence harvest of harbor seals from previous years. For the southeast stock, the calculated PBR is 2,114 animals. The average annual subsistence harvest from southeast between 1992 and 1996 was 1,749 animals, representing 83 percent of the PBR for this stock. (PSEIS, 2004a, 3.8-30)

The context of subsistence harvest of northern fur seals is much different from that of Steller sea lions, and subsistence effort is highly concentrated in the communities of St. Paul and St. George in the Pribilof Islands. The commercial harvesting of northern fur seals on the Pribilof Islands began shortly after the first known discovery of the islands in 1786. The commercial harvest was continued by the United States when the Pribilof Islands came under U.S. jurisdiction with the purchase of Alaska from Russia in 1867 and lasted until 1984. The method of subsistence harvest of northern fur seals on the Pribilof Islands is a direct outgrowth of the commercial harvest that took place on the islands and, due to this historical and legislative context, the organization of the subsistence harvest of northern fur seals is very different from the organization of the harvest of Steller sea lions elsewhere. The subsistence harvest of northern fur seals in the Pribilof Islands is conducted as an organized, land-based, group activity.

NMFS entered into co-management agreements with the Tribal Governments of St. Paul and St. George under Section 119 of the MMPA in 2000 and 2001, respectively. These agreements are specific to the conservation and management of northern fur seals and Steller sea lions in the Pribilof Islands, with particular attention to the subsistence take and use of these animals. To minimize negative effects on the population, the fur seal subsistence harvest has been limited to a 47-day harvest season (June 23-August 8) during which only sub-adult male seals may be taken. In addition, the Fur Seal Act authorizes subsistence harvest of fur seals by Native Americans dwelling on North Pacific Ocean coasts (but not for seal skins, which must be disposed of), but that harvest can only be from canoes paddled by less than five people each and without the use of firearms.

On St. Paul Island, annual subsistence take of northern fur seals ranged between 754 and 522 animals over the period 2000-2003. On St. George, the annual harvest ranged between 203 and 121 animals over this same period. St. Paul and St. George are predominately Alaska Native communities. In 2000, the total population of St. Paul was 532, 86 percent of whom were Alaska Native/Native American. St. George had a population of 152 in 2000, of whom 92 percent were Alaska Native/Native American. These communities are relatively isolated, even by rural Alaska standards, from other population centers and private sector economic opportunities are relatively limited in both communities as well.

While northern fur seal harvest is an essential component of subsistence in the Pribilof Islands, only three non-Pribilof communities, the Aleutian communities of Akutan, Nikolski, and Unalaska, show any level of harvest for northern fur seals for any year in which ADF&G harvest surveys were conducted. For Akutan, during the single year that shows up in the data, fur seal harvests accounted for about 2 percent of the total subsistence harvest in the community. This is based on pounds per person of total subsistence harvests for the community. For Nikolski and Unalaska, fur seal harvests accounted for about two-tenths of 1 percent and less than one-tenth of 1 percent of total community subsistence harvest, respectively.

As noted in the fur seal subsistence harvest EIS (NMFS 2005a), the cumulative effect of the harvest of fur seal prey species (pollock) may result in a conditionally significant adverse impact on fur seals. Such an impact could potentially result in impacts on subsistence hunting opportunities, if the impacts result in a drop in fur seal population leading to a drop in subsistence harvest levels. However, the potential competition between fur seals and the pollock fishery is not well understood (Chapter 8). Higher pollock harvest under an alternative would result in a higher potential for prey competition compared to alternatives with a lower pollock TAC.

Prohibited Species-Based Subsistence Activities

Under existing conditions, catches of non-groundfish species, such as halibut, crab, herring, and salmon occur as incidental catch during the operations of the groundfish fishery. These species are also harvested by subsistence fishermen. Incidental PSC species catches are all managed through the incidental catch restrictions imposed on fishing operations by regulation, but environmental justice concerns vary by species.

Halibut, Crab, and Herring Fisheries

Halibut is a widely used subsistence resource in Alaskan coastal communities. In terms of the relationship of subsistence harvest to commercial fishing activities, incidental catch in the groundfish fisheries, recreational catch, and wastage in the commercial halibut fishery are all considered before commercial halibut quotas are set each year. While PSC limits on halibut are often closely approached in both the BSAI and GOA trawl fisheries, the limits themselves prevent, by design, adverse impacts to halibut stocks and associated subsistence fisheries. Crab and herring subsistence use is relatively low compared to stock sizes, such that they are not taken into account when ADF&G sets commercial quotas for these species and the amounts taken during the groundfish fisheries are considered to have no impact on species stocks. Under existing conditions, PSC limits for herring have never been reached. Area PSC limits for crab are sometimes reached, but, as with halibut, these limits themselves are designed to prevent adverse impacts to the stock. Additionally, it is important to note that most subsistence fishing for halibut, crab, and herring occurs in nearshore State waters. Extensive areas of State waters are closed to the use of trawl gear including, for example, State waters around Kodiak as well as State waters in all of Southeast Alaska. This has the effect of avoiding or limiting the impacts of groundfish fishing on subsistence fishing activities related to halibut, crab, and herring take under existing conditions.

Subsistence Salmon Fisheries

Unlike the case of other prohibited species-related subsistence activities noted above, potential degradation of salmon subsistence fisheries through groundfish fishery bycatch has been an ongoing management issue and has been a concern repeatedly noted in the public comment process for recent fishery EISs.[35] This concern focuses on the recent status of the western Alaska stocks and the contribution of salmon bycatch to decreasing subsistence harvests. The bycatch species of most concern in the groundfish fishery are Chinook and chum salmon, and of these two, Chinook is considered a much larger potential problem. Also unlike other subsistence based on prohibited species stocks, most salmon subsistence harvest occurs in freshwater systems.

The overall bycatch of Chinook and chum salmon is very small relative to state harvests; bycatch take could pose a threat to specific stocks (rivers of origin). Some western stocks of Chinook salmon are currently depressed. If individual stocks become so depressed that full closure of direct fisheries is insufficient to enable a rebound in the population, then any additional mortality, including bycatch, could negatively impact the stock. It is estimated that 58-70 percent of Chinook salmon bycatch in the BSAI groundfish fisheries may originate from western Alaska stocks, but it is unknown what proportion of these salmon are specifically from depressed stocks.

Although the numbers of salmon bycatch and associated impacts of western Alaska stocks would appear relatively low, salmon bycatch is nonetheless a contentious issue given the current state of some of the salmon fisheries. For example, in 2000, "salmon returns throughout the Yukon and Kuskokwim River drainages and the entirety of Norton Sound were less than 50 percent of the 20-year average" (D. Eggers, ADF&G Juneau, pers. comm., cited in Witherell et al. 2002). These, and correspondingly adverse conditions in the Bristol Bay sockeye salmon fishery, have led to constraints on commercial, recreational, and subsistence harvests, and in 1998, 1999, and 2000, an economic disaster was formally declared for western Alaska based on collapsed salmon runs (Witherell et al. 2002).

[35] As noted in previous sections, almost all salmon bycatch in the groundfish fisheries is taken in the pollock fishery specifically, and the BSAI pollock fishery is of primary concern.

While year-to-year fluctuations are common (and are more so in the GOA than in the BSAI fisheries), in recent years chum salmon bycatch in the BSAI has increased significantly in the past few years (Table 7-1). A large increase in BSAI Chinook salmon bycatch also has occurred for the past several years. This is in contrast to BSAI Chinook bycatch increase in 2001 to about 7 percent over the 1990-2001 annual average (Witherell et al. 2002). Chapter 7 has a thorough discussion on salmon bycatch in the groundfish fisheries. Given the existing conditions in the salmon fisheries, and the specific importance of salmon to overall subsistence take, the cause of public concern over salmon bycatch in the Alaska groundfish fisheries, even in low numbers, is readily apparent.

In 1999, fisheries in four management areas accounted for 77 percent of the total subsistence salmon harvest statewide. These were Yukon (232,070 salmon; 25 percent of the statewide total); Kuskokwim (202,413 salmon; 21 percent); Northwest Alaska (154,294 salmon; 16 percent); and Bristol Bay (143,756 salmon; 15 percent). The total estimated salmon subsistence harvest in Alaska in 1999 was 975,617 fish based on annual harvest assessment programs.

In 1999, the largest subsistence harvests of Chinook salmon occurred in the Kuskokwim area (77,660 salmon; 50 percent of the statewide total), followed by Yukon (50,515 salmon; 33 percent), Bristol Bay (13,009 salmon; 8 percent); and Northwest (6,242 salmon; 4 percent). Three areas dominated the subsistence chum salmon harvest in 1999: Yukon (162,670 salmon; 48 percent of the statewide harvest), Northwest (115,676 salmon; 34 percent), and Kuskokwim (47,612 salmon; 14 percent). Given that the majority of salmon subsistence harvest occurs in the Yukon and Kuskokwim areas, the following discussion will focus on these areas.

Yukon Area

As in the past, today’s residents of the Yukon River area rely heavily on fish for food. While non-salmon species provide an important component of the overall fish harvest, salmon comprises the bulk of the total subsistence fish harvested. Although four salmon species are harvested in the Yukon drainage subsistence fishery, Chinook, chum, and coho salmon comprise the majority of the subsistence harvests. In portions of the drainage, subsistence harvests of some species, especially chum and Chinook salmon, are substantial.

Often subsistence harvests far exceed commercial harvests. Depending on the drainage area, subsistence fishing occurs from late May through early October. Extended family groups, typically representing several households, often undertake subsistence salmon fishing and typically cooperate to harvest, process, preserve, and store salmon for subsistence use. In 1999, it was estimated that 2,888 households participated in the fishery, with households distributed over a large number of communities that are in turn spread across a wide geographic region.

Kuskokwim Area

The harvest of fish and wildlife for subsistence use is an important component of the mixed subsistence-cash economy throughout the Kuskokwim area. The subsistence salmon fishery in the region is one of the largest and most important in the state. ADF&G Subsistence Division studies in the region indicate that fish contribute as much as 85 percent of the total pounds of fish and wildlife harvested in a community annually, and salmon as much as 53 percent of the total annual harvest (Coffing 1991).

Approximately 1,700 households in the region annually harvest salmon for subsistence use. Many other households, which are not directly involved in catching salmon, participate by assisting family and friends with cutting, drying, smoking, and associated preservation activities (salting, canning, and freezing).

Subsistence catches of Chinook salmon in the Kuskokwim area exceed the commercial catch of this species.

There are 37 communities consisting of approximately 4,200 households with subsistence permits within the Kuskokwim area. The majority of the area households are situated within the drainage of the Kuskokwim River. Chinook salmon are particularly sought after for subsistence use in the Kuskokwim area and account for a large percentage (38 percent) of the total subsistence salmon catch.

Other Subsistence Activities

Beyond use of Steller sea lions and northern fur seals as subsistence resources and potential bycatch-related impacts to subsistence salmon fisheries, the proposed alternatives could have indirect impacts on other subsistence pursuits. These types of impacts fall into two main categories – loss of income and joint production opportunities. Specifically:

- Impacts to other subsistence pursuits as a result of loss of income from the commercial groundfish fishery. This income could be used to purchase fuel, vehicles, other subsistence-related gear, or otherwise offset expenses required to engage in a range of subsistence pursuits.

- Impacts to other subsistence pursuits as a result of the loss of opportunity to use commercial fishing gear and vessels for subsistence pursuits, where these assets are used in such a manner that commercial and subsistence catches are jointly produced, based on shared use of fixed and variable inputs.

The variables that influence these indirect impacts are numerous and complex. Although some impacts are likely to accrue to a limited number of communities that participate directly in the fishery, quantification of these impacts is problematic. Impacts to subsistence in communities that participate in the fishery primarily through investment and control of quota (the CDQ communities) could occur through loss of income that would be directed toward subsistence pursuits, but quantification of these impacts is also problematic.

It is also important to note that the geographic distribution of these potential impacts varies widely. Joint production impacts are confined to those individuals who own or have immediate access to vessels participating in the groundfish fisheries. The impacts of a potential loss of income would fall on a larger group of individuals, many of whom may live significant distances away from the coastal communities where commercial vessels are home ported. It should also be noted that these are both still relatively constrained areas compared to the potential subsistence salmon impacts discussed above. Though their geographic base may be narrow, the impacts on families may be much more immediate and of greater magnitude.

Income-Related Indirect Subsistence Impacts

The potential loss of income resulting in funds not being available for subsistence pursuits is a very complex issue. Facets of the various issues involved include:

- Loss of income can impact everyone associated with the fishery, and people associated with the fishery live in communities ranging across Alaska and the Pacific Northwest.

- Income specifically contributed by groundfish pursuits may be a larger or smaller proportion of funds used for subsistence by individuals or families. The relationship between loss of income and specific subsistence outcomes is not entirely straightforward.

- Income associated with the groundfish fishery can be derived from direct participation through employment, investment in vessels or processors, and/or through control of quota, such as through CDQ-related revenues.

Joint Production-Related Subsistence Impacts

The second type of potential indirect impact, loss of opportunity for joint production, applies to groundfish communities with direct participation in the fishery (i.e., only vessels that currently participate in the commercial fishery can be used for joint production). In general, there is little information on joint production within the groundfish fishery. Some general points about the vessels involved include:

- Not all vessels in the commercial groundfish fishery are also used for subsistence.

- Depending on the community involved, a greater or lesser proportion of the commercial fleet engaged in the local commercial groundfish fishery is owned and operated by non-residents.

- Joint production can occur in at least two fundamentally different ways. Subsistence fish can be retained during commercial trips, or separate trips using the commercial vessel and gear may be made for subsistence harvests.

- Smaller vessels are most likely to be involved in joint production. Though the number of joint production vessels is unknown, nearly all of the smaller class vessels that engage in the groundfish fishery are also involved in some combination of (or all of) the salmon, halibut, sablefish, and herring subsistence fisheries.

In practical terms, joint production opportunities also vary by gear type. Although quantitative data are slim, knowledge of the industry suggests that little subsistence takes place using trawl vessels compared to other gear types. Among the fixed gear classes, much more time is directed toward sablefish, salmon, and herring than is devoted to groundfish; therefore, the joint production opportunities in this class would remain relatively high independent of the groundfish management alternative chosen.

13.2 Environmental Justice Impacts

Potential impacts of fishery management actions that drive environmental justice issues can include a wide range of factors, including employment/municipal revenue in communities with significant percentages of special populations (such as Alaska Native communities or communities with potentially vulnerable population “pockets” such as minority processing workforce); revenue to Alaska Native-owned local catcher vessel fleets; revenue impacts to CDQ communities or other special allocation communities; subsistence activities associated with groundfish, marine mammals (Steller sea lion and northern fur seal), and salmon; and the loss of income from fishing that would be otherwise directed toward subsistence pursuits and/or the loss of access to commercial fishing vessels and gear that would otherwise be available for joint production opportunities, among others. Related issue area impacts examined within this document included prohibited species, marine mammals, and social and economic impacts (including communities, and subsistence).

GOA/BSAI Area Impacts

While the GOA and BSAI management areas are geographically distinct, impacts to communities and populations are not always exclusively derived from one management area or the other. Vessels from southeast and southcentral Alaska regions tend to fish the GOA, and groundfish processing plants in those regions tend to exclusively process groundfish from the GOA. Within the Kodiak region, local processing plants primarily process groundfish from the GOA, and the local harvest fleet tends to harvest GOA groundfish (with the exception of some larger vessels home ported in the city of Kodiak itself, which may also fish in the BSAI area). In the case of the Alaska Peninsula and Aleutian Islands region, within the eastern part of the region, the larger processing plants may process groundfish from both the GOA and the BSAI regions. In the western portion of the Alaska Peninsula and Aleutian Islands region, the processing plants tend to process groundfish caught within the BSAI. Local fleets from the eastern and western parts of the Alaska Peninsula and Aleutian Islands region generally fish the GOA and the BSAI, respectively, but larger vessels may fish both regions. Vessels from the Washington Inland Waters and the Oregon Coast regions may fish either or both the GOA and BSAI management areas, but as described under existing conditions, the only known potential environmental justice issues associated with either region would involve the catcher/processor or mothership fleets based out of the Washington Inland Waters region.

The following analysis compares the alternatives to the impacts that may occur under Alternative 2.

13.2.1 Alternative 1

Fishery Revenues

Changes in groundfish fishery revenues can impact fishery-dependent communities. Overall, alternative specifications that reduce groundfish TACs available to commercial harvest could involve lower gross revenues accruing to communities, and therefore lower levels of income and profits. These reductions, if large enough, may have negative effects on the economies of communities through lower levels of labor income and employment to those dependent on fishing activities. Additionally, levels of municipal revenue and taxes within communities could also be negatively affected. Alternatively, increases in TACs could potentially result in higher revenues, employment, income, and profits generating positive effects in communities. It is important to note, however, that increases or decreases in TACs by themselves may not result in substantial changes in revenue, employment, income, or profits if actual harvest levels are constrained by other factors, as discussed below.

As outlined in the existing conditions discussion above, a number of groundfish fishing communities have predominately Alaska Native populations, and the in-region processing workforce is often composed of predominantly minority populations. A decrease in labor income and employment within these communities would result in a potential environmental justice impact.

BSAI Alternative 1 TACs are equal to the status quo harvest strategy Alternative 2 TACs. The impacts of Alternative 1 in the BSAI are the same as those of Alternative 2. Further discussion is deferred to Section 13.2.2.

Figure 12-1 in Chapter 12, indicates that GOA gross revenues under Alternative 1 are higher than they would be under the status quo harvest strategy alternative, Alternative 2. However, as noted in the discussion of the figure, halibut PSC constraints may prevent much of the additional flatfish TAC from being harvested. Therefore, it is likely that the Alternative 1 GOA revenue estimate is upward biased.

Alternative 1 does have higher GOA pollock harvests than Alternative 2, and this is likely to have some positive revenue effects. This alternative should be associated with (a) modestly higher groundfish revenue than the status quo harvest strategy, (b) higher total in-region groundfish processing value, (c) higher total value of catcher vessel operations, labor income, and employment levels, and (d) higher in-region processing employment. Higher in-region processing value would correspond to additional municipal revenue and taxes to local communities. The higher gross revenues would likely result in benefits to local communities, including those with minority populations or low income populations and would not pose an environmental justice concern.

CDQ Groups

CDQ groups are predominately composed of Alaska Native communities with relatively limited commercial economic opportunities, so any disproportionate adverse impacts to this program and region are likely to have disproportionate adverse effects on minority and low income populations resulting in environmental justice concerns. CDQ allocations under Alternative 1 would be equal to those under the status quo harvest alternative, because the TACs under the two alternatives are the same. Thus Alternative 1 impacts would be the same as Alternative 2 impacts. Further discussion is deferred to Section 13.2.2

Aleutian Islands Pollock Allocations (Aleut Corporation/Community of Adak)

The AI pollock TAC is fixed in regulation (at 19,000 mt, so long as the ABC remains greater than 19,000 mt) and, since implementation of this program, only a small fraction of the TAC has been harvested. While increases in harvest levels may occur over time (with gains in experience) to the overall benefit of the Aleut Corporation and the community of Adak, this alternative will not directly impact the AI pollock TAC or its allocation.

Subsistence

Subsistence activities typically disproportionately involve Alaska Native communities and populations, and in a few cases (such as Steller sea lion and northern fur seal subsistence) exclusively involve Alaska Native individuals and groups. As a result, adverse impacts to subsistence pursuits are likely to involve minority populations resulting in disproportionate impacts and environmental justice concerns. Subsistence activities where there are potential environmental justice issues include the following: harvest of groundfish (all regions), incidental catches of Steller sea lion, harbor seals, and northern fur seal (primarily an activity in the Alaska Peninsula/Aleutian Islands region), and incidental catches of salmon (primarily an issue in western Alaska, where poor runs potentially further degraded by groundfish bycatch takes have adversely affected subsistence harvests in the recent past).

Additionally, commercial fishing often provides employment and income needed to support the purchase of inputs used in the pursuit of subsistence activities. Alternatives that affect employment and wages in the commercial fishery can be expected to have indirect impacts on subsistence activities, including the loss of income from fishing that would otherwise be directed toward subsistence pursuits and the loss of access to commercial fishing vessels and gear that would otherwise be available for joint production.

Groundfish

GOA and BSAI groundfish stocks are not expected to become overfished as a result of Alternative 1. As subsistence use of groundfish stocks is considered to be relatively limited, the existing subsistence take is not anticipated to be adversely affected.

Marine Mammals

Because the BSAI Alternative 1 TACs of interest are equal to the Alternative 2 TACs, discussion regarding BSAI fisheries impacts on marine mammals is deferred to Section 13.2.2. Impacts related to any additional incidental take of Steller sea lions, harbor seals, or fur seals, by definition, would occur disproportionately to environmental justice populations. As outlined in Chapter 8, incidental takes of the eastern stock of Steller sea lions are limited to the GOA sablefish longline fishery with an annual mean mortality of 1.37 animals (Angliss and Outlaw 2005, Table 5). GOA harbor seal takes occur in the longline fisheries for groundfish, including sablefish. Mean annual harbor seal mortality is 4.0 animals (Angliss and Outlaw 2005, Table 10). Alternative 1 TACs for the most important species caught with longlines in the GOA (Pacific cod, sablefish) are not larger than the Alternative 2 levels. Thus, Alternative 1 is expected to have marine mammal subsistence impacts similar to those under the status quo harvest alternative. Further discussion is deferred to Section 13.2.2. Based on these similar impacts, it is expected that Alternative 1 impacts on marine mammals would disproportionately impact subsistence users in the same manner as Alternative 2 and would therefore create the same environmental justice concerns.

Salmon

In general, a reduction in pollock TACs may reduce salmon bycatch and thereby reduce adverse effects on subsistence salmon fishing. Conversely, increases in pollock TACs in particular may lead to higher salmon bycatch and increased adverse effect. The size of these changes remains unclear. Salmon bycatch in the pollock fisheries may be more closely related to environmental conditions than to TACs; bycatch has increased in recent years even though TACs have been relatively stable. As outlined in Section 12.10, the BSAI pollock pelagic trawl fishery has been taking large numbers of Chinook and chum salmon in recent years, although the subsistence impact has been indeterminate.

As outlined above, Alternative 1 would involve higher commercial pollock harvest levels in the GOA, whereas total BSAI pollock harvest levels would be equal to Alternative 2 levels. Under Alternative 1, as total harvest levels would remain relatively unchanged within the BSAI, impacts on subsistence are expected to be the same as those under Alternative 2. As pollock TACs within the GOA are greater under Alternative 1, it is possible that sufficient impacts to subsistence salmon stocks could occur that would potentially result in environmental justice impacts. However, the higher pollock harvests in GOA are relatively modest, and the key salmon incidental catch concerns are with the BSAI pollock fisheries.

Joint Production Opportunities

Commercial fishing often provides employment and income needed to support the purchase of inputs used in the pursuit of subsistence activities. Fishery management alternatives that affect commercial fishing-related employment and wages can be expected to have indirect impacts on subsistence activities. This specifically concerns the loss of income from fishing that would otherwise be directed toward subsistence pursuits and the loss of access to commercial fishing vessels and gear that would otherwise be available for joint production.

As outlined above, Alternative 1 is likely to be associated with increases in commercial harvests in the GOA compared to the status quo harvest strategy, with overall groundfish fishing revenues as well as corresponding labor income and employment increasing from existing levels. Some level of indirect impacts to subsistence activities due to loss of income or access to vessels or equipment could occur in the BSAI under Alternative 1, but it is unlikely that these losses are large enough to result in subsistence-related joint production impacts due to the indirect nature of the linkage between groundfish harvesting outcomes and these types of impacts.

13.2.2 Alternative 2

Fishery Revenues

Alternative 2 is the status quo TAC setting strategy. Under Alternative 2, pollock and Pacific cod ABCs in the BSAI and in the GOA are expected to decline from 2006 levels in 2007 and 2008. These ABC declines, which are not a part of this action, will constrain TACs for these species under Alternative 2. Thus pollock and Pacific cod TACs, associated harvests, and associated revenues, are expected to decline under the status quo. In the BSAI, it is anticipated that the Council will increase TACs for other species, as pollock and Pacific cod TACs decline, in order to maintain overall harvests at levels close to the two million metric ton OY. However, these increases in TACs of what are often lower valued species compared to pollock and Pacific cod, lead to offsetting declines in overall fishery revenues in the BSAI. Status quo revenues decline in the GOA as well, where increases in TACs for other species are not expected. Thus, even though the status quo harvest strategy is retained, fishery participants, including relevant minority populations and low-income populations, may still experience positive or negative impacts from changes in fishery conditions. Any negative change may result in an environmental justice concern if the change disproportionately impacts minority or low income participants.

According to gross revenue estimates, overall groundfish fishing revenue in the GOA and the BSAI is projected to fall by 10 percent and 3.8 percent, respectively, in 2007 and by 19.9 percent and 9.6 percent, respectively, in 2008 compared to most recent year (2006) conditions. Total in-region groundfish processing value would therefore fall. The total value of catcher vessel operations would similarly be reduced, as likely would the corresponding level of labor income and, perhaps, employment. The projected decline may be significant enough, particularly in 2008, to result in in-region processing employment decreasing over 2006 conditions. Reductions in in-region processing value could reduce municipal revenue and taxes to the local communities. Depending on the extent and nature of the economic and employment impacts of the reduction in groundfish fishery activity, their distribution across sectors, and their distribution across communities and regions, environmental justice impacts could occur under this alternative.

CDQ Groups

Although overall CDQ allocations would not decrease from 2006 levels under the status quo harvest strategy, groundfish fishing revenues associated with CDQ allocations are projected to decrease due to changes in the composition of the CDQ species allocations. The most important factor for the CDQ groups will be the reduction in pollock TACs, since pollock is an extremely important species for them. Labor income, employment, and revenue would correspondingly fall within CDQ groups. According to gross revenue estimates, overall groundfish fishing revenue within CDQ groups is projected to fall 4.7 percent in 2007 and 19.5 percent in 2008 over most recent year (2006) conditions. Depending on the extent and nature of the economic and employment impacts of the reduction in groundfish fishery revenues, environmental justice impacts could occur under this alternative compared to 2006. It is possible that the overall reduction in groundfish fishery production under this alternative may result in a partially offsetting change in price as discussed in Chapter 12, so actual adverse outcomes may be mitigated at least to some degree.

Aleutian Islands Pollock Allocations (Aleut Corporation/Community of Adak)

As described under Alternative 1, the AI pollock TAC is fixed in regulation (at 19,000 mt, so long as the ABC remains greater than 19,000 mt) and, since implementation of this program, only a small fraction of the TAC has been harvested. While increases in harvest levels may occur over time (with gains in experience) to the overall benefit of the Aleut Corporation and the community of Adak, this alternative will not directly impact the AI pollock TAC or its allocation.

Subsistence

Groundfish

GOA and BSAI groundfish stocks are not expected to become overfished as a result of Alternative 2. As subsistence use of groundfish stocks is considered to be relatively limited, the existing subsistence take is not anticipated to be adversely affected.

Marine Mammals

Table 8-3 shows the average annual mortality and serious injury for marine mammals from the groundfish fisheries and from total human caused mortality and serious injury. Much of the mortality and serious injury that is not attributed to the groundfish fisheries occurs due to other fisheries or to subsistence harvest. The subsistence harvest of a marine mammal species may be impacted if the total human caused mortality and serious injury approached the PBR for the stock. Of those species that are included in subsistence harvest, the GOA stock of harbor seals and the western stock of Steller sea lions experience mortality and serious injury approaching the PBR. Total mortality and serious injury for harbor seals and for Steller sea lions is 95 and 94 percent of PBR respectively. If either of these stocks decline further, the PBR may be adjusted downward which could result in the PBR being exceeded under the current levels of mortality. Adjustments to mortality would be considered, with reduction in subsistence harvest one possibility.

The availability of prey for Steller sea lions and fur seals is discussed in Section 8.3.2. The groundfish fisheries under Alternatives 1 through 4 would be conducted within the Steller sea lion protection measures and are unlikely to result in competition with Steller sea lions for prey species that would adversely modify their designated critical habitat or cause jeopardy of extinction. Because the potential competition for prey is reduced by the Steller sea lion protection measures, it is unlikely that the groundfish fisheries would cause a decline in the Steller sea lion population that would result in considering potential restrictions on subsistence harvests. There is also possibility of prey competition between the pollock fisheries and fur seals, which is a regional concern for the Pribilof Islands. The nature of this competition is not well understood, but it could be a concern for subsistence harvest of fur seals which are depleted under the MMPA. Total mortality and serious injury for fur seals does not approach the PBR so the potential for considering reductions in subsistence harvest is less likely to occur (Table 8-3). However, prey competition might lead to reductions in the PBR.

Given the current status of the western DPS of Steller sea lions, and the populations of harbor seals and fur seals, the subsistence take is not expected to be affected by Alternative 2 and therefore no disproportionate impacts that would lead to environmental justice concerns are expected.

Salmon

Pollock fisheries account for most of the chinook and chum salmon incidental catches. Pollock TACs decline from recent levels under Alternative 2, in both the GOA and BSAI. For given environmental and regulatory conditions, a decline in pollock fishing effort is likely to be associated with a reduction in salmon incidental catches. The impact on subsistence fishing activity is unclear, and would depend on the natal streams of the salmon taken in the pollock fishery, the age of the salmon typically taken by the trawlers, salmon mortality prior to returning to spawn, the overall salmon run size, and escapement needs. Modifications in the methods for reducing salmon bycatch, implemented under an exempted fishing permit (EFP) in August 2006 for the fall 2006 are expected to lead to reductions in bycatch rates in the fishery for given environmental conditions and fishery TACs. Given the current status of salmon as discussed in Chapter 7, the subsistence take is not expected to be affected by Alternative 2 and therefore no disproportionate impacts that would lead to environmental justice concerns are expected

Joint Production Opportunities

As outlined above, Alternative 2 would involve overall 2007-2008 decreases to commercial groundfish harvests, gross revenues, corresponding labor income and employment, in the GOA and the BSAI when compared to most recent year (2006) conditions Indirect impacts to subsistence activities due to loss of income or access to vessels or equipment could occur in the GOA and the BSAI under Alternative 2, which could be an environmental justice impact.

13.2.3 Alternative 3

Fishery Revenues

Alternative 3 would involve a significant decrease in TACs and associated projected groundfish fishing revenues compared to the status quo harvest strategy (Alternative 2) in both the GOA and the BSAI. Total in-region groundfish processing value would therefore decrease. The total value of catcher vessel operations would similarly decrease as would likely corresponding levels of labor income and employment. In-region processing employment would likely fall from baseline conditions. In-region processing value may incrementally reduce municipal revenue and taxes to the local communities. Impacts related to decreases in revenues could be high and adverse. Depending on the extent and nature of the economic and employment impacts of the reduction in groundfish fishery activity, their distribution across sectors, and their distribution across communities and regions, disproportionate impacts to minority populations and low-income populations could occur under this alternative.

CDQ Groups

As outlined above, Alternative 3 would involve lower TACs and commercial harvests in the BSAI than Alternative 2. Overall CDQ allocations would similarly decrease. Total levels of labor income, employment, and revenue would correspondingly fall within CDQ groups. Depending on the extent and nature of the economic and employment impacts of the reduction in groundfish fishery activity under this alternative, impacts may disproportionately accrue to minority and low-income populations in the CDQ region.

Aleutian Islands Pollock Allocations (Aleut Corporation/Community of Adak)

As described under Alternatives 1 and 2, the AI pollock TAC is fixed in regulation (at 19,000 mt, so long as the ABC remains greater than 19,000 mt) and, since implementation of this program, only a small fraction of the TAC has been harvested. While increases in harvest levels may occur over time (with gains in experience) to the overall benefit of the Aleut Corporation and the community of Adak, this alternative will not directly impact the AI pollock TAC or its allocation.

Subsistence

Groundfish

GOA and BSAI groundfish stocks would not become overfished as a result of Alternative 3. As subsistence use of groundfish stocks is considered to be relatively limited, the existing subsistence take is not anticipated to be adversely affected.

Marine Mammals

Under Alternative 3, incidental takes of Steller sea lions, harbor seals and fur seals are expected to be lower than those under Alternative 2. Given existing stock population dynamics, the subsistence take would not be affected. The decreased level of trawling effort under Alternative 3 could result in a reduction of lost gear, thus diminishing the threat of entanglement compares to Alternative 1 and 2. Alternative 3, with lower pollock TACs than Alternative 2, would create less risk of potential prey impacts on northern fur seals. Given existing population dynamics and the level and nature of subsistence activities, the subsistence take is not anticipated to be affected under Alternative 3. Alternative 3 would likely result in less potential for disproportionate impacts on those dependent on subsistence resources compared to Alternative 2, and therefore, presents less environmental justice concerns for subsistence than Alternative 2

Salmon

As outlined above, Alternative 3 would involve lower commercial groundfish harvest levels in the GOA and the BSAI compared to the status quo harvest strategy. In general, a reduction in pollock harvest levels may reduce bycatch-driven negative effects on subsistence fishing, although the size and nature of these effects remains unclear. Alternative 3 would likely result in less potential for disproportionate impacts on those dependent on subsistence resources compared to Alternative 2, and therefore, presents less environmental justice concerns for subsistence than Alternative 2

Joint Production Opportunities

Alternative 3 would involve lower commercial harvests in the GOA and the BSAI compared to Alternative 2. Overall groundfish fishing revenues as well as corresponding labor income and employment would be at lower levels. Consequently, indirect impacts to subsistence activities due to loss of income or access to vessels or equipment could occur in the GOA and the BSAI under Alternative 3. The reduction in income and employment may disproportionately impact those who depend on subsistence activities. Therefore, the reduction of income and employment under Alternative 3 may pose more of an environmental justice concern than those employment levels seen under Alternatives 1 and 2.

13.2.4 Alternative 4

Fishery Revenues

Alternative 4 has significantly lower TACs and associated projected groundfish revenue estimates compared to Alternative 2 in both the GOA and BSAI. Total in-region groundfish processing value would therefore significantly decrease. The total value of catcher vessel operations and levels of labor income and employment would likely fall significantly from baseline conditions. Fishing-related revenues to the local communities would also fall. Many of these impacts may be high and adverse and fall disproportionately on minority populations and/or low-income populations.

CDQ Groups

Overall CDQ allocations would be less than Alternative 2 in parallel with overall commercial harvest decreases under Alternative 4. Consequently, total levels of labor income, employment, and group revenue are projected to fall within CDQ groups. Depending on the extent and nature of the economic and employment impacts of the reduction in groundfish fishery activity under this alternative, impacts may disproportionately accrue to minority and low-income populations in the CDQ region.

Aleutian Islands Pollock Allocations (Aleut Corporation/Community of Adak)

As described under Alternatives 1 and 2, the AI pollock TAC is fixed in regulation (at 19,000 mt, so long as the ABC remains greater than 19,000 mt) and, since implementation of this program, only a small fraction of the TAC has been harvested. While increases in harvest levels may occur over time (with gains in experience) to the overall benefit of the Aleut Corporation and the community of Adak, this alternative will not directly impact the AI pollock TAC or its allocation.

Subsistence

Groundfish

GOA and BSAI groundfish stocks would not become overfished as a result of Alternative 4. As subsistence use of groundfish stocks is considered to be relatively limited, the existing subsistence take is not anticipated to be adversely affected.

Marine Mammals

Under Alternative 4, the GOA and BSAI groundfish fisheries are expected to result in fewer takes of Steller sea lions, fur seals and harbor seals compared to Alternative 2, but more than under Alternative 3. Incidental take of northern fur seals is also expected to decrease relative to existing conditions. Less trawling effort under Alternative 4 could result in a reduction of lost gear, thus diminishing the threat of entanglement compared to Alternative 2. Given the harvest levels under the different alternatives and nature of subsistence activities, the subsistence take of Steller sea lions, harbor seals, and northern fur seals is likely to be less affected by Alternative 4 compared to Alternative 2 but more than Alternative 3. Alternative 4, with lower pollock TACs than Alternative 2, would create less risk of potential prey impacts on northern fur seals. Therefore the potential for disproportionate effects under Alternative 4 and the accompanying environmental justice concerns for subsistence harvest are less likely than Alternative 2 but more likely than Alternative 3.

Salmon

As outlined above, Alternative 4 would involve much lower commercial pollock harvest levels in the GOA and the BSAI than Alternative 2 but more than Alternative 3. This level of harvest would potentially reducing salmon bycatch-driven subsistence impacts under Alternative 4 compared to Alternative 2 but may result in more impacts than Alternative 3. Therefore the potential for disproportionate effects under Alternative 4 and the accompanying environmental justice concerns for subsistence harvest are less likely than Alternative 2 but more likely than Alternative 3.

Joint Production Opportunities

Alternative 4 would involve lower commercial harvests in the GOA and the BSAI than Alternative 2 but more than Alternative 3. With decreases in overall groundfish fishing revenues, corresponding labor, income, and employment would also be less than under Alternative 2. These decreases may result in indirect impacts to joint production subsistence pursuits among populations participating in the GOA and the BSAI groundfish fisheries. Because the potential income and employment are lower under Alternative 4 than under Alternative 2, the disproportionate effects may be greater under Alternatives 4 and therefore the environmental justice impacts of the decreased income and employment under Alternative may also be greater than under Alternative 2.

13.2.5 Alternative 5

Fishery Revenues

Alternative 5 would involve a complete cessation of commercial groundfish fishing activities in both regions. Total in-region groundfish processing value would be reduced to zero, as would all other incomes, revenues, and taxes associated with commercial groundfish fisheries. High and adverse impacts would be experienced by minority populations and low-income populations across multiple regions.

CDQ Groups

CDQ allocations would decrease to zero. Total income, employment, and revenues associated with commercial groundfish fisheries within CDQ groups would be eliminated. Communities in the CDQ region, with proportionately large minority and low-income populations with limited employment opportunities, would be adversely affected.

Aleutian Islands Pollock Allocations (Aleut Corporation/Community of Adak)

Adak pollock allocations would decrease to zero. Total income, employment, and revenues associated with commercial groundfish fisheries utilizing the Adak allocation would be eliminated. Immediate economic impacts to the community of Adak would be adverse but could be more indirect than direct in nature given the relatively modest harvest levels that have occurred under this allocation to date.

Subsistence

Groundfish

As Alternative 5 would involve a complete cessation of commercial groundfish fishing activities in both regions, GOA and BSAI groundfish stocks would not become overfished. As subsistence use of groundfish stocks is considered to be relatively limited, the existing subsistence take would not be affected.

Marine Mammals

Under Alternative 5, no groundfish fishery-related incidental takes of Steller sea lions, harbor seals, or northern fur seals would occur. The subsistence take of each species would not be affected. There would be no competition for prey. Therefore, no environmental justice concerns regarding subsistence harvested related to this alternative exists.

Salmon

As Alternative 5 would involve a complete cessation of commercial groundfish fishing activities, salmon bycatch from the commercial groundfish fishery would cease. The subsistence take of salmon would not be affected. Therefore, no environmental justice concerns regarding subsistence harvested related to this alternative exists.

Joint Production Opportunities

Alternative 5 would involve a complete cessation of commercial groundfish fishing activities in both regions. Joint production opportunities specifically associated with the groundfish fishery would be eliminated.

13.3 Reasonably Foreseeable Future Actions That May Alter the Environmental Justice Impacts of This Action

Impacts related to the reasonably foreseeable future actions that may have a continuing, additive, and meaningful relationship to the direct and indirect effects of the alternatives on economic and social dimensions of the environment are outlined in Section 12.17. Elements of each of these actions could, when combined with each of the proposed alternatives, indirectly lead to environmental justice impacts within specific populations.

Ecosystem-based fisheries management approaches could include management actions such as closure areas that could disproportionately affect Alaska Native fishermen or communities. Depending on the individual program design, rationalization programs could also function to adversely impact smaller, predominately Alaska Native communities through consolidation of harvesting and processing operations, resulting in a net flow of economic activities directly and indirectly associated with commercial fishing away from some communities and toward others. The expansion of state-managed groundfish fisheries could lead to a reallocation of federally managed fishery revenues to state-managed fisheries. The resultant decrease in Federal TACs could potentially affect Alaska Native fishermen or communities, particularly CDQ groups, but work to the benefit of other local fisheries and small boat fleets, including those associated with other Alaska Native communities (such as the Pacific cod 3 percent State waters allocation near Adak).

The CDQ Program-related amendments to the Magnuson-Stevens Act made through the Coast Guard bill address allocations of groundfish, halibut, and crab to the CDQ Program, allocations of quota among the CDQ groups, management of the CDQ fisheries, eligible communities, limits on allowable investments, the creation of a CDQ Panel, compliance with State of Alaska reporting requirements, and other aspects of program administration and oversight by the State and the NMFS, on behalf of the Secretary. Most of these Magnuson-Stevens Act amendments will require revisions to Federal regulations that will be implemented through proposed and final rulemaking. Amendments also will need to be made to the BSAI groundfish FMP and the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs.

The Magnuson-Stevens Act amendments require the increase in allocations of groundfish to the CDQ Program from 7.5 percent to 10 percent "upon the establishment of a quota program, fishing cooperative, sector allocation, or other rationalization program." Two recent actions to revise sector allocations for Pacific cod (BSAI Amendment 85) and to create cooperatives for non-AFA trawl catcher/processors fishing for flatfish, Atka mackerel, and Pacific ocean perch (BSAI Amendment 80) likely will trigger the requirement to increase the allocations of these species to the CDQ Program from 7.5 percent to 10 percent, once these amendments are approved by the Secretary. These FMP amendments are expected to be effective for the 2008 groundfish fisheries. In addition to future increases in allocations to the CDQ Program, the Coast Guard bill also will require revisions to the management of incidental catch in the groundfish CDQ fisheries to provide an incidental catch allowance for each species in addition to its directed fishing allocation. These requirements will effectively increase the allocation to the CDQ Program beyond 10 percent to provide for the additional incidental catch in the CDQ fisheries that is now authorized by the Magnuson-Stevens Act. The benefits of these increased allocations to the CDQ Program are offset by the costs of the corresponding decrease in allocations for the non-CDQ sectors of the BSAI groundfish fisheries. As this legislation is incorporated into the groundfish FMPs and fishing regulations, it is likely to increase the potential benefits CDQ groups obtain from any given specifications level as a result of increased allocations to the CDQ Program and changes in regulations governing management of the CDQ fisheries and oversight of the economic development aspects of the program.

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Chapter 16 References

The references used in each chapter are listed at the end of the chapter.

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Chapter 17 Index

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Appendix A: BSAI Stock Assessment and Fishery Evaluation (SAFE) Reports

This document is included by reference. The 2005 versions for each species or species group may be found here: http://www.afsc.noaa.gov/refm/stocks/assessments.htm

Appendix B: GOA Stock Assessment and Fishery Evaluation (SAFE) Reports

This document is included by reference. The 2005 versions for each species or species group may be found here: http://www.afsc.noaa.gov/refm/stocks/assessments.htm

Appendix C: Ecosystem Considerations

This document is included by reference. The 2005 version may be found here: http://www.afsc.noaa.gov/refm/stocks/assessments.htm

Appendix D: Economic Status Report

This document is included by reference. The 2005 version may be found here: http://www.afsc.noaa.gov/refm/stocks/assessments.htm

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Appendix E: 2007-2008 OFL, ABC, and TAC Projection Methodology

This appendix describes the approaches taken to generate the TACs for the alternative harvest strategies. These are summarized in Chapter 2, Tables 2-1, 2-2, 2-3, and 2-4 of this EIS.

Overview of the methodology

TAC projections for species with age-structured population models (those falling in Tier 3 or higher of the BSAI and GOA FMP Tier system), were based on the models that were used for the OFL and ABC projections in the Fall of 2005. These models are described in some detail in the 2005 GOA and BSAI SAFE documents. The only change made from Fall 2005, was the use of new, updated, projections of 2006 fishery mortality, that became available in April 2006. These models were run using different assumptions about target fishing mortality rates (*F*) depending on the harvest strategy alternative being evaluated.

The 2006 mortalities were used to run the models to produce 2007 ABCs. NMFS in-season management staff made TAC and associated mortality projections for 2007, given the projected ABCs, and these new 2007 mortality estimates were then used to rerun the models to produce ABCs for 2008.

TACs for species in other tiers were estimated in different ways for different alternatives, using the methods described below.

2006 Mortality estimates

In April 2006, in-season managers in NMFS Alaska Region made projections of fishing mortality for 2006.

The BSAI catch projections for 2006 were completed by the Alaska Region's Sustainable Fisheries In-season management staff on April 17, 2006, using information on 2006 catches through April 8. The projected catch for each species is equal to the sum of (1) the 2006 open access and CDQ catch through April 8, and (2) the 2003-2005 average open access and CDQ catch for the period April 9 through December 31. Pollock CDQ ICA is included in open access pollock ICA.

If the TAC amount for a species was fully utilized, or (in most cases) if the 2006 preliminary projection exceeded the 2006 TAC, the TAC projection was set equal to the TAC. In one case, Alaska plaice, catch exceeded TAC by April 8, and the mortality projection exceeds the TAC. Otherwise, the preliminary projection was used for the catch projection.

Data used to make the BSAI projections came from the NMFS Alaska Region's Catch Accounting System.

The GOA catch projections for 2006 were completed by the Alaska Region's Sustainable Fisheries In-season management staff on April 14, 2006, using information on 2006 catches through April 8. Pollock (outside of the eastern GOA), Pacific cod (outside of the eastern GOA), Pacific ocean perch (outside of the eastern GOA), other rockfish (outside of the eastern GOA), pelagic shelf rockfish (outside of the eastern GOA), sablefish, shortraker, rougheye, northern rockfish, thornyheads, demersal shelf rockfish, skates, and Atka mackerel, tend to be fully utilized. The 2006 catch estimates for these species were set equal to the 2006 TACs adopted by the Council in December 2005. This approach may tend to overestimate the catches of these species, and thus impart a conservative bias to the OFL and ABC projection in 2007.

The projected catch for other species (including pollock in the eastern GOA, Pacific cod in the eastern GOA, deepwater flatfish, Rex sole, flathead sole, shallow water flatfish, arrowtooth, SEO Pacific ocean perch, SEO other rockfish, SEO Pelagic shelf rockfish, and "other species") were projected to be equal to the sum of (1) the 2006 catch through April 8, and (2) the 2003-2005 catch for a period approximating the period from April 8 through December 31.

Projections were made for individual managements areas (such as the Eastern, Central, and Western GOA) as well as for the GOA as a whole. Data used to make the GOA projections came from the NMFS Alaska Region's Catch Accounting System.

Alternative 1

If the sum of the TACs did not exceed the OY for the management area (2,000,000 mt in the BSAI, and 800,000 mt in the GOA), the TACs were calculated using the following procedure. For Tier 3 species, Alternative 1 TACs were set equal to ABCs calculated so as to produce fishing rates equal to $maxF_{ABC}$. For other species, TACs were set equal to 2007 ABCs.

If the sum of the TACs did exceed the OY, TACs were adjusted so that they would not exceed the OY. TACs did not exceed the OY in the GOA. They did exceed the OY in the BSAI. In the BSAI the Alternative 1 TACs were set equal to the TACs adopted under Alternative 2. Under Alternative 2, the Council already sets TACs equal to the OY.

Alternative 2

Alternative 2 ABCs for 2007 were projected using the 2006 mortality estimates, and the fishing rates using for the preferred alternative in the Fall of 2005.

For species in Tier 3, 2007 Alternative 2 TACs were set equal to or less than the ABCs projected by the population dynamics models. Differences between TACs and ABCs were defined by NMFS Alaska Region in-season managers, on the basis of patterns shown by the Council in the past. In the BSAI, declines in pollock and Pacific cod ABCs from the model were offset by increases in TACs for flatfish species, suggested by in-season managers in such a way that the total sum of TACs was kept equal to the the top of the OY. Adjustments were made to the TACs for State groundfish guideline harvest levels for Pacific cod in the GOA and BSAI, and to the ABC for pollock in the GOA.

A similar procedure was used to project Tier 3 TACs for 2008. In the BSAI, the 2007 TACs were used as estimates of 2007 fishing mortality. This accounts for the fact that the BSAI fisheries take almost the entire OY (19,284 mt, or 1 percent, remained in 2005). In the GOA, fishing mortalities associated with the TACs were estimated by NMFS Alaska Region in-season managers on the basis of experience in recent years, and these were used in the population dynamics models to project 2008 ABCs. This accounted for the fact that in numerous instances in the GOA, fishermen are unable to fully harvest the available TACs because of halibut PSC constraints.

For species in other tiers, for which age structured population models were unavailable, GOA TACs were set equal to the 2007 TACs adopted by the Council in December 2005. In the BSAI, the 2007 TACs adopted by the Council in December 2005 were used as a starting point, but were frequently adjusted, in both 2007 and 2008, in order to maintain the overall sum of TACs at the 2,000,000 mt OY level, and equal to or less than the projected ABCs, in the face of declining pollock, Pacific cod, and Atka mackerel TACs.

Alternative 3

For Tier 3 species, Alternative 3 TACs were set so as to produce a fishing rate equal to that in the most recent five years. TACs for other species were set equal to the estimate of the most recent five years of average catches for the species.

Alternative 4

Under Alternative 4, TACs for rockfish species determined to be in Tier 3 were set equal to ABCs calculated using an F_{spr} equal to $F_{75\%}$. Tier 5 species are normally set using an F equal to 75 percent of the estimate of natural mortality (F=0.75M), and multiplying this value by the estimated biomass. Under Alternative 4, Tier 5 rockfish TACs were estimated using F = 0.5M. The estimates of M and biomass were taken from the 2005 SAFE documents.

The remaining Alternative 4 TACs were calculated by subtracting the estimate of area rockfish TACs from the lower end of the regional OY (1,400,000 mt in the BSAI, and 116,000 mt in the GOA), and reducing all other area Alternative 2 TACs by equal proportions, so as to reduce them in aggregate to the difference between the lower end of the OY and the sum of the rockfish TACs. This was done to ensure that the TACs summed to the lower end of the OY in each region (this is 1,400,000 mt in the BSAI, and 116,000 mt in the GOA).

Alternative 5

Under Alternative 5, all TACs were set to zero. This alternative falls outside the statement of purpose and need for this action, but it is necessary to consider a “no action” alternative to comply with CEQ regulations.

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Appendix F: Gross Revenues Methodology[36]

Section 12.2 of this EIS provides estimates of the gross revenue impacts of the alternative harvest strategies. Gross revenue estimates were provided for the BSAI non-CDQ groundfish fisheries, the BSAI CDQ groundfish fisheries, and the GOA groundfish fisheries. Estimates were provided for the status quo harvest strategy for recent years, and projected for 2007 and 2008. This appendix describes the ways in which the estimates, summarized in the tables and figures of Section 12.2, were prepared.

How revenues were estimated

The gross revenue model treats TACs as exogenous inputs to the model. The TACs are provided in great detail with individual species disaggregated by region, subregion and alternative. There are currently approximately 85 individual GOA and 33 individual BSAI TACs specified for each of the five alternatives. However, data limitations in catch and price reporting, confidentiality restrictions, and the need to consolidate the information dictate aggregation of these individual TACs into major species groups. The gross revenue model thus aggregates individual species TACs into 12 species groups in the BSAI and 12 in the GOA, however, not all species groups are used in both regions.

To estimate revenue by major species group, sector, and region, in 2007 and 2008, the model must determine what proportion of the species group regional TAC is likely to be caught by vessels operating in the CP and CV sectors, respectively. This is done by calculating the quantity weighted average catch rate of all the species within a species group and sector over the five most recent years that catch data are available. It is important to note that the catch rate parameter is not the rate of harvest that the sector has had of any specific sector based allocation within a region. It is simply the proportion of the overall regional TAC that the sector has historically taken in the region in question.

Multiplication of the sector/species group based catch rates by the appropriate TAC specification yields an estimate of potential revenue generating tonnage harvested by each sector, in each region, and for each species group. However, not all that is caught is retained. Thus, the model must also estimate the retention rate for each sector, region, and species group. This is done by calculating the sum of retained tons by sector, region, and species group for the past five years, and dividing it by the similarly summed catch tons. The retention rate is then multiplied by the estimated catch, with the result being an estimate of revenue generating tonnage harvested and retained by each sector, in each region, and for each species group. Multiplication of these estimates by an appropriate price vector results in estimated revenue for each sector/region/species group[37]. However, the prices that must be used have different meanings.

The model uses three price vectors: the round weight equivalent first wholesale prices per metric ton from the CP sector, the round weight ex-vessel prices per metric ton from the CV sector, and the round weight equivalent first wholesale value per metric ton from the shoreside processing sector. To evaluate

[36] As noted at the start of Section 4.10, NMFS AKR is in the process of developing the gross revenues model to differentiate between revenues flowing to the CP sector, and revenues flowing to the CV and shoreside processing sectors. When this work is completed, it may be combined with regional impact models to provide a more complete picture of the interaction of the fisheries and onshore communities. This will address the needs of an ecosystem approach to management for a more complete view of the fishery-human community interactions. Appendices F and G provide a status report on the state of this project.

[37] Data on available harvest actually taken and retained were provided specifically for this analysis by Mary Furuness of the NMFS Alaska Region In-Season Management Staff.

shoreside gross revenues (net of payments to CVs) the model simply takes the difference between the shoreside first wholesale price and the ex-vessel price for a species group in a region.

The round weight equivalent first wholesale prices (CPs and shoreside) are defined as the total value of all products derived from the species group, divided by the total round weight of retained catch for the species group. The source of these data is industry reported values and tonnages from weekly production reports (WPR) and the commercial operator annual reports (COAR). Ex-vessel prices are calculated similarly, however, the source is Alaska Commercial Fisheries Entry Commission (CFEC) corrected fish ticket data files. CFEC does extensive work on fish ticket data to correct for end-of-season bonuses and other price anomalies. As discussed above, the prices used to estimate shoreside revenue, net of CV payments, are the difference between the first wholesale and ex-vessel prices[38].

The price estimates described above are not yet available for 2005 or 2006. At present, the 2004 price vectors are applied to all revenue estimates in the model in order to compare past estimates of revenues and projections of future revenues in nominal dollar terms. What this means is that estimates of 2004, 2005, and 2006 revenue, presented in Section 12.2, are made with 2004 prices. Similarly, the projections of 2007 and 2008 revenues are made with the same 2004 price vector. Thus, the availability of prices and the lack of stochastic price estimation/projection models that can be used in this analysis are serious limitations. As discussed below, the model incorporates an implicit assumption that demand for the different species is perfectly elastic, so that changes in supply do not change price.

Table F-1 and F-2 provide model parameter data on catch rates, retention rates, and prices used in the model for the BSAI and GOA, respectively. The data are provided by species group and sector. It is important to note that the shoreside sector uses the CV sector catch and retention rates under the obvious assumption that all CV catch that is retained is processed by the shoreside sector. Also, the model provides revenue estimates for both the CDQ and non-CDQ allocations of TAC in the BSAI. However, available data did not allow calculation of a CDQ specific set of parameters and so the overall BSAI parameters are used.

[38] The data used to calculate these prices have been prepared specifically for this analysis by Terry Hiatt of the Alaska Fisheries Science Center.

Table F-1 BSAI Model Parameters: Catch Rates, Retention Rates, and Prices by Sector and Species Group.

Species Group	Catcher Processors			Catcher Vessels			Shoreside		
	C%	R%	Price	C%	R%	Price	C%	R%	VA
Pollock	41%	97%	812	58%	100%	211	58%	100%	488
Sablefish	17%	94%	4,835	27%	95%	4,009	27%	95%	2,668
Pacific cod	73%	98%	1,133	28%	99%	445	28%	99%	712
Arrowtooth	92%	36%	595	8%	16%	53	8%	16%	334
Flathead sole	69%	76%	1,054	6%	53%	60	6%	53%	195
Rock sole	81%	61%	796	4%	25%	124	4%	25%	41
Turbot	62%	88%	2,252	7%	20%	597	7%	20%	99
Yellowfin	52%	86%	652	46%	43%	119	46%	43%	51
Flats (other)	63%	26%	1,588	5%	32%	82	5%	32%	477
Rockfish	83%	61%	796	3%	55%	231	3%	55%	542
Atka	93%	86%	600	2%	39%	98	2%	39%	296
Other	96%	22%	348	7%	18%	540	7%	18%	715

Using the methods described above, the gross revenue model estimates revenues earned in 2004, 2005, and 2006. Using identical methods, the model projects revenues by alternative for 2007 and 2008. These estimates are provided separately for the BSAI and GOA regions and were further divided into two BSAI categories: the fish available in the CDQ reserves, and the fish available for use by fishermen harvesting non-CDQ TACs. The CDQ reserve was assigned 10 percent of the pollock TAC, 20 percent of the sablefish allocated to hook-and-line and pot fishermen, 7.5 percent of the sablefish allocated to trawl fishermen, and 7.5 percent of all other groundfish species.

Unfortunately, available CDQ fishery data are not sufficiently detailed to allow estimation of CDQ fishery specific catch and retention rates, and so the overall BSAI rates are used.

Table F-2 GOA Model Parameters: Catch Rates, Retention Rates, and Prices (dollars per metric ton retained weight) by Sector and Species Group.

Species Group	Catcher Processors			Catcher Vessels			Shoreside		
	C%	R%	Price	C%	R%	Price	C%	R%	VA
Pollock	1%	79%	346	85%	99%	225	85%	99%	359
Sablefish	17%	86%	4,742	77%	96%	4,377	77%	96%	728
Pacific cod	15%	94%	1,202	73%	95%	571	73%	95%	598
Arrowtooth	34%	44%	748	22%	48%	80	22%	48%	200
Flathead sole	10%	81%	1,300	13%	89%	182	13%	89%	379
Rex sole	22%	95%	2,164	3%	83%	329	3%	83%	543
Flats deep	4%	9%	136	8%	91%	221	8%	91%	543
Flats shallow	2%	75%	816	23%	92%	232	23%	92%	499
Rockfish	42%	85%	868	35%	93%	316	35%	93%	360
Atka	38%	69%	370	4%	20%	34	4%	20%	361
Skates	52%	35%	341	27%	66%	285	27%	66%	177
Other	6%	30%	341	23%	39%	285	23%	39%	177

There are several important conceptual problems with this modeling approach. First, changes in the quantity of fish produced might be expected to lead to changes in the price paid. However, in this analysis, a constant price, by species and product form, was used to value the different quantities that would be produced under the different alternatives. Since, all else equal, an increase in quantity should reduce price, while a decrease in quantity should increase price, leaving price changes out of the calculation may lead to an exaggeration of actual gross revenue changes across alternatives. The magnitude of this exaggeration is unknown. This is probably not a serious issue for Alternative 2, because TAC changes are relatively small. However, Alternative 1 often increases TACs significantly, so the absence of a price effect may overstate revenue increases because prices would be expected to decline. In contrast, the method may cause the revenue reductions for Alternatives 3 and 4, which have moderate reductions in TACs of highly valued species, to be overstated, since the declines in TACs might be offset to some extent by increases in prices. It is not an issue for Alternative 5, since with no harvests, prices are undefined.

Second, harvest from many of the groundfish fisheries is limited by halibut PSC catch constraints, rather than attainment of TAC. Halibut PSC constraints are not proportional to groundfish specifications and are likely to bind sooner, or impose greater costs on groundfish fishermen, given higher levels of TAC specifications that lead to increased effort. This suggests that model gross revenue estimates for alternatives with generally higher levels of TAC for species with halibut bycatch may be biased upward. This may not be an issue for most alternatives in this analysis, since TACs generally are the same as or lower than TACs in 2006. The exception could be Alternative 1, which increases some TACs significantly.

Predicting the portion of increased Alternative 1 TAC that may be caught is problematic. At present, annual halibut PSC is often a binding constraint on flatfish fisheries. In many flatfish fisheries, particularly in the GOA, harvests are currently constrained significantly below status quo TACs by halibut PSC limits. In other words, an increase in flatfish TACs associated with Alternative 1 would not increase flatfish catch, and gross revenues, unless industry is able to avoid catching halibut. Thus, it is not likely that Alternative 1 flatfish revenue would increase significantly, versus Alternative 2 levels, when PSC is taken into consideration. Further, Alternative 1 decreases pollock and Pacific cod TACs relative to 2006 levels. The result, compared to the most recent year, may be increased effort in flatfish fisheries, especially in the BSAI. Such a shift in effort could lead to increased halibut bycatch earlier in the season. Thus, the flatfish TAC alone will not determine how much flatfish is caught. That will be the result of a dynamic relationship between TACs for other species, flatfish TACs, and the resulting effort distribution between other targets, such as pollock and Pacific cod.

The flatfish PSC condition suggests that large increases in flatfish TACs in the GOA under Alternative 1 may not translate into correspondingly large increases in catch and revenue. It may be more appropriate, therefore, to consider Alternative 2 revenue estimates (i.e. those most similar to the present specifications) for flatfish as proxies for a more likely harvest outcome than the Alternative 1 revenue estimates. Alternative 1 flatfish revenue estimates should at least be interpreted as upper bound revenue estimates in the absence of binding PSC constraints.

Other assumptions incorporated into the model may affect the results in ways that are difficult to determine. These include (1) the use of first wholesale prices per metric ton of retained weight, which implies that outputs at the wholesale level change in proportion to the production of the different species; (2) the use of broad species categories in the analysis implies that changes in specifications would result in proportional changes in the harvest by all the gear groups harvesting a species; (3) similarly, the lumping of species together in categories implies that changes in specifications would result in proportional changes in the harvest of all the species included in the category.

Model Testing with Monte Carlo Simulations

Given the limitations of the modeling method an attempt has been made to utilize Monte Carlo simulations to forecast revenue estimates and establish measures of confidence in those estimates. Microsoft Excel's Crystal Ball simulation software has been used to develop forecasts for each of the revenue estimates in the model.

In the analysis of BSAI and GOA Catcher Processor groundfish revenue it has long been the policy of the NOAA Fisheries Alaska Region analysts to utilize the "true value" per metric ton of retained round catch. That is, price per metric ton is calculated as total value of all products at the first wholesale level, divided by total retained tons. This price multiplied by sector or gear type retained catch and then summed across all sectors will return the total product value. In contrast, if the average of the price per metric ton per week is calculated to estimate an annual average price, there can be considerable downward effects of low valued (e.g. poor quality or small amounts) observations. The difficulty with this arises when establishing the parameters for price assumptions in the Monte Carlo simulation.

This analysis used distribution fitting functions within Crystal Ball to fit a distribution to the raw pricing data. The software employs standard statistical methods to estimate the mean, variance, and standard deviation of the data. In the case of BSAI CP pollock, for example, a lognormal distribution was fit, however, the mean was more than $200 per metric ton less than the "true value" per metric ton that has been using in the model. The result, if the estimated average from Crystal Ball replaces the "true value," is substantially lower estimation of revenue. The example given here is for BSAI CP pollock, however, this difficulty was also encountered with ex-vessel values. Ex-vessel pricing tends to have greater difficulty with low value outliers.

A further issue that emerged from the analysis is that there is insufficient data in the present model to fit distributions to the catch and retention rate parameter. The model contains five years of annual data, however, Crystal Ball must have fifteen observations. As a result, Beta distributions were assumed but this resulted in very little sensitivity in forecast value to catch or retention rates. In some cases, this was expected; however, this tendency persisted in species groups/regions where considerable variability exists in catch and retention rates.

These efforts at model testing have been illuminating and have identified several areas that need significantly more work before Monte Carlo simulation of forecast revenue can be used to further develop the subject gross revenue model. It will be necessary, for example, to refine methods for calculating average prices per week and to address price outliers. It will also be necessary to decompose catch and retention rates to weekly levels to establish enough observations to fit distributions to be used in simulation assumptions. As this will need to be done for each combination of region, species group, and sector, considerable work will be involved in developing a dataset that will allow Monte Carlo simulation to be a functional part of the gross revenue model.

Estimates of first wholesale gross revenues

Estimates of the projected TACs, by species group, are summarized for both the BSAI and for the GOA in Tables F-3 and F-4 for 2007 and 2008, respectively. Estimates of the percentage changes between 2006 TACs and the 2007 and 2008 projected TACs for the alternatives are summarized in Tables F-5 and F-8.

Estimates of the 2007 and 2008 gross revenues by alternative and sector are summarized in Table F-9. Detailed estimates of the 2007 and 2008 values for each of the CP, CV, shoreside and combined sectors for the BSAI, BSAI CDQ, and GOA regional breakouts are provided in the 24 tables labeled F-10 through F-33

Table F-3 2007 Projected TACs in metric tons

Species	A1	A2	A3	A4	A5	2006
BSAI						
Pollock	1,438,810	1,438,810	1,128,165	1,014,321	0	1,504,010
Sablefish	5,200	5,200	3,900	3,645	0	5,820
Pacific cod	144,045	144,045	136,091	100,979	0	188,180
Arrowtooth	20,000	20,000	15,800	14,020	0	13,000
Flathead sole	22,000	22,000	9,500	15,423	0	19,500
Rock sole	85,736	85,736	23,200	60,103	0	41,500
Turbot	2,630	2,630	3,700	1,844	0	2,740
Yellowfin	117,100	117,100	37,300	82,090	0	95,701
Flats (other)	20,000	20,000	15,108	14,020	0	11,500
Rockfish	22,304	22,304	17,919	7,907	0	18,954
Atka	90,900	90,900	61,500	63,723	0	63,000
Other	31,275	31,275	29,769	21,925	0	30,275
Total	**2,000,000**	**2,000,000**	**1,481,952**	**1,400,000**	**0**	**1,994,180**
GOA						
Pollock	82,207	70,507	56,250	32,409	0	85,807
Sablefish	13,700	13,700	11,300	6,297	0	14,840
Pacific cod	44,705	44,705	24,971	20,549	0	52,264
Arrowtooth	184,400	38,000	16,400	17,467	0	38,000
Flathead sole	39,100	9,148	2,200	4,205	0	9,077
Rex sole	44,000	10,300	3,400	4,734	0	9,200
Flats deep	8,677	8,677	680	3,988	0	8,665
Flats shallow	51,450	19,972	5,150	9,180	0	19,972
Rockfish	34,575	31,904	21,135	10,708	0	30,713
Atka	4,700	1,500	488	689	0	1,500
Skates	8,056	8,056	2,678	3,703	0	8,056
Other	4,500	4,500	1,911	2,068	0	13,856
Totals	**520,070**	**260,969**	**146,563**	**116,000**	**0**	**291,950**

Table F-4: 2008 Projected TACs in metric tons

Species	A1	A2	A3	A4	A5	2006
BSAI						
Pollock	1,187,710	1,187,710	1,030,866	838,234	0	1,504,010
Sablefish	4,500	4,500	3,800	3,154	0	5,820
Pacific cod	118,049	118,049	123,287	82,749	0	188,180
Arrowtooth	144,800	144,800	16,300	101,501	0	13,000
Flathead sole	52,200	52,200	9,200	36,591	0	19,500
Rock sole	111,600	111,600	22,500	78,229	0	41,500
Turbot	2,630	2,630	3,500	1,844	0	2,740
Yellowfin	106,400	106,400	36,400	74,584	0	95,701
Flats (other)	147,737	147,737	14,223	103,560	0	11,500
Rockfish	22,304	22,304	17,923	8,007	0	18,954
Atka	65,100	65,100	51,900	45,633	0	63,000
Other	36,970	36,970	30,014	25,915	0	30,275
Total	**2,000,000**	**2,000,000**	**1,359,913**	**1,400,000**	**0**	1,994,180
GOA						
Pollock	80,907	72,007	60,050	35,097	0	85,807
Sablefish	12,300	12,300	11,000	5,995	0	14,840
Pacific cod	30,436	30,436	22,315	14,835	0	52,264
Arrowtooth	170,300	38,000	16,700	18,521	0	38,000
Flathead sole	32,700	9,252	2,300	4,509	0	9,077
Rex sole	19,300	10,300	3,900	5,020	0	9,200
Flats deep	8,677	8,677	657	4,229	0	8,665
Flats shallow	51,450	19,972	4,947	9,734	0	19,972
Rockfish	35,365	32,793	21,380	11,208	0	30,713
Atka	4,700	1,500	570	731	0	1,500
Skates	8,056	8,056	2,678	3,927	0	8,056
Other	14,637	4,500	1,911	2,193	0	13,856
Totals	**468,828**	**247,793**	**148,408**	**116,000**	**0**	**291,950**

Table F-5: Percent differences between 2007 BSAI TACs for the Alternatives, and 2006 BSAI TACs

Species	A1	A2	A3	A4	A5	2006 mt
Pollock	-4%	-4%	-25%	-33%	-100%	1,504,010
Sablefish	-11%	-11%	-33%	-37%	-100%	5,820
Pacific cod	-23%	-23%	-28%	-46%	-100%	188,180
Arrowtooth	54%	54%	22%	8%	-100%	13,000
Flathead sole	13%	13%	-51%	-21%	-100%	19,500
Rock sole	107%	107%	-44%	45%	-100%	41,500
Turbot	-4%	-4%	35%	-33%	-100%	2,740
Yellowfin	22%	22%	-61%	-14%	-100%	95,701
Flats (other)	74%	74%	31%	22%	-100%	11,500
Rockfish	18%	18%	-5%	-58%	-100%	18,954
Atka	44%	44%	-2%	1%	-100%	63,000
Other	3%	3%	-2%	-28%	-100%	30,275
Totals	**0%**	**0%**	**-26%**	**-30%**	**-100%**	1,994,180

Table F-6: Percent differences between 2008 BSAI TACs for the Alternatives, and 2006 BSAI TACs

Species	A1	A2	A3	A4	A5	2006 mt
Pollock	-21%	-21%	-31%	-44%	-100%	1,504,010
Sablefish	-23%	-23%	-35%	-46%	-100%	5,820
Pacific cod	-37%	-37%	-34%	-56%	-100%	188,180
Arrowtooth	1014%	1014%	25%	681%	-100%	13,000
Flathead sole	168%	168%	-53%	88%	-100%	19,500
Rock sole	169%	169%	-46%	89%	-100%	41,500
Turbot	-4%	-4%	28%	-33%	-100%	2,740
Yellowfin	11%	11%	-62%	-22%	-100%	95,701
Flats (other)	1185%	1185%	24%	801%	-100%	11,500
Rockfish	18%	18%	-5%	-58%	-100%	18,954
Atka	3%	3%	-18%	-28%	-100%	63,000
Other	22%	22%	-1%	-14%	-100%	30,275
Totals	**0%**	**0%**	**-32%**	**-30%**	**-100%**	**1,994,180**

Table F-7: Percent differences between 2007 GOA TACs for Alternatives, and 2006 GOA TACs

Species	A1	A2	A3	A4	A5	2006 mt
Pollock	-4%	-18%	-34%	-62%	-100%	85,807
Sablefish	-8%	-8%	-24%	-58%	-100%	14,840
Pacific cod	-14%	-14%	-52%	-61%	-100%	52,264
Arrowtooth	385%	0%	-57%	-54%	-100%	38,000
Flathead sole	331%	1%	-76%	-54%	-100%	9,077
Rex sole	378%	12%	-63%	-49%	-100%	9,200
Flats deep	0%	0%	-92%	-54%	-100%	8,665
Flats shallow	158%	0%	-74%	-54%	-100%	19,972
Rockfish	13%	4%	-31%	-65%	-100%	30,713
Atka	213%	0%	-67%	-54%	-100%	1,500
Skates	0%	0%	-67%	-54%	-100%	8,056
Other	-68%	-68%	-86%	-85%	-100%	13,856
Totals	**78%**	**-11%**	**-50%**	**-60%**	**-100%**	**291,950**

Table F-8: Percent differences between 2008 GOA TACs for Alternatives, and 2006 GOA TACs

Species	A1	A2	A3	A4	A5	2006 mt
Pollock	-6%	-16%	-30%	-59%	-100%	85,807
Sablefish	-17%	-17%	-26%	-60%	-100%	14,840
Pacific cod	-42%	-42%	-57%	-72%	-100%	52,264
Arrowtooth	348%	0%	-56%	-51%	-100%	38,000
Flathead sole	260%	2%	-75%	-50%	-100%	9,077
Rex sole	110%	12%	-58%	-45%	-100%	9,200
Flats deep	0%	0%	-92%	-51%	-100%	8,665
Flats shallow	158%	0%	-75%	-51%	-100%	19,972
Rockfish	15%	7%	-30%	-64%	-100%	30,713
Atka	213%	0%	-62%	-51%	-100%	1,500
Skates	0%	0%	-67%	-51%	-100%	8,056
Other	6%	-68%	-86%	-84%	-100%	13,856
Totals	**61%**	**-15%**	**-49%**	**-60%**	**-100%**	**291,950**

Table F-9: Estimates of Gross Revenue by Sector (millions of dollars)

BSAI	CP		CV		Shoreside		Combined	
Alternative	2007	2008	2007	2008	2007	2008	2007	2008
Alt 1	$669	$640	$181	$167	$396	$365	$1,247	$1,172
Alt 2	$669	$640	$181	$167	$396	$365	$1,247	$1,172
Alt 3	$506	$462	$144	$146	$314	$318	$963	$926
Alt 4	$468	$447	$128	$118	$279	$257	$875	$822
Alt 5	$0	$0	$0	$0	$0	$0	$0	$0
BSAI CDQ	**CP**		**CV**		**Shoreside**		**Combined**	
Alternative	2007	2008	2007	2008	2007	2008	2007	2008
Alt 1	$118	$99	$5	$4	$10	$8	$133	$112
Alt 2	$118	$99	$5	$4	$10	$8	$133	$112
Alt 3	$92	$84	$4	$4	$8	$7	$104	$95
Alt 4	$83	$70	$4	$3	$7	$6	$93	$79
Alt 5	$0	$0	$0	$0	$0	$0	$0	$0
GOA	**CP**		**CV**		**Shoreside**		**Combined**	
Alternative	2007	2008	2007	2008	2007	2008	2007	2008
Alt 1	$75	$58	$87	$76	$67	$59	$228	$193
Alt 2	$38	$35	$81	$71	$55	$49	$173	$154
Alt 3	$23	$22	$60	$58	$37	$37	$119	$118
Alt 4	$16	$16	$37	$34	$25	$23	$78	$73
Alt 5	$0	$0	$0	$0	$0	$0	$0	$0

Notes: All estimates have been rounded to the nearest million dollars. This causes some cells to read “0" when actual value is non-zero. Cells may not sum to totals due to rounding.

Table F-10: Projected BSAI CP 2007 First Wholesale Gross Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	421.832	421.832	330.757	297.380	0
Sablefish	3.452	3.452	2.589	2.420	0
Pacific cod	108.375	108.375	102.391	75.974	0
Arrowtooth	3.635	3.635	2.872	2.548	0
Flathead sole	11.302	11.302	4.880	7.923	0
Rock sole	30.950	30.950	8.375	21.696	0
Turbot	3.001	3.001	4.222	2.104	0
Yellowfin	31.387	31.387	9.998	22.003	0
Flats (other)	4.744	4.744	3.583	3.325	0
Rockfish	8.293	8.293	6.663	2.940	0
Atka	40.285	40.285	27.255	28.241	0
Other	2.163	2.163	2.059	1.516	0
Total	**669.417**	**669.417**	**505.642**	**468.069**	**0**

Table F-11 Projected BSAI CV 2007 EX-Vessel Gross Revenue (millions of dollars)

Species Group	Ex-Vessel Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	157.640	157.640	123.605	111.132	0
Sablefish	4.453	4.453	3.340	3.122	0
Pacific cod	16.348	16.348	15.445	11.460	0
Arrowtooth	0.013	0.013	0.011	0.009	0
Flathead sole	0.036	0.036	0.015	0.025	0
Rock sole	0.105	0.105	0.028	0.074	0
Turbot	0.019	0.019	0.027	0.013	0
Yellowfin	2.525	2.525	0.804	1.770	0
Flats (other)	0.025	0.025	0.019	0.017	0
Rockfish	0.075	0.075	0.060	0.027	0
Atka	0.056	0.056	0.038	0.040	0
Other	0.204	0.204	0.194	0.143	0
Total	**181.500**	**181.500**	**143.587**	**127.832**	**0**

Table F-12 Projected BSAI Shoreside 2007 Gross Revenue Net of CV Payments (millions of dollars)

Species Group	Shoreside Value Added by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	364.879	364.879	286.100	257.229	0
Sablefish	2.964	2.964	2.223	2.078	0
Pacific cod	26.169	26.169	24.724	18.345	0
Arrowtooth	0.084	0.084	0.066	0.059	0
Flathead sole	0.115	0.115	0.050	0.081	0
Rock sole	0.035	0.035	0.009	0.025	0
Turbot	0.003	0.003	0.004	0.002	0
Yellowfin	1.092	1.092	0.348	0.765	0
Flats (other)	0.143	0.143	0.108	0.100	0
Rockfish	0.176	0.176	0.141	0.062	0
Atka	0.170	0.170	0.115	0.119	0
Other	0.270	0.270	0.257	0.190	0
Total	**396.101**	**396.101**	**314.147**	**279.056**	**0**

Table F-13 Projected BSAI Combined 2006 Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	944.350	944.350	740.461	665.741	0
Sablefish	10.869	10.869	8.152	7.620	0
Pacific cod	150.892	150.892	142.560	105.779	0
Arrowtooth	3.733	3.733	2.949	2.617	0
Flathead sole	11.452	11.452	4.945	8.028	0
Rock sole	31.089	31.089	8.413	21.794	0
Turbot	3.023	3.023	4.253	2.119	0
Yellowfin	35.003	35.003	11.150	24.538	0
Flats (other)	4.912	4.912	3.710	3.443	0
Rockfish	8.544	8.544	6.864	3.029	0
Atka	40.512	40.512	27.409	28.400	0
Other	2.637	2.637	2.510	1.849	0
Total	**1,247.017**	**1,247.017**	**963.377**	**874.957**	**0**

Table F-14 Projected BSAI CP 2008 First Wholesale Gross Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	348.214	348.214	302.230	245.754	0
Sablefish	2.987	2.987	2.522	2.094	0
Pacific cod	88.817	88.817	92.757	62.258	0
Arrowtooth	26.319	26.319	2.963	18.449	0
Flathead sole	26.816	26.816	4.726	18.797	0
Rock sole	40.286	40.286	8.122	28.239	0
Turbot	3.001	3.001	3.993	2.103	0
Yellowfin	28.519	28.519	9.756	19.991	0
Flats (other)	35.041	35.041	3.373	24.563	0
Rockfish	8.293	8.293	6.664	2.977	0
Atka	28.851	28.851	23.001	20.224	0
Other	2.557	2.557	2.076	1.792	0
Total	**639.699**	**639.699**	**462.185**	**447.242**	**0**

Table F-15 Projected BSAI CV 2008 EX-Vessel Gross Revenue (millions of dollars)

Species Group	Ex-Vessel Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	144.587	144.587	125.494	102.044	0
Sablefish	4.551	4.551	3.843	3.190	0
Pacific cod	14.484	14.484	15.127	10.153	0
Arrowtooth	0.105	0.105	0.012	0.074	0
Flathead sole	0.091	0.091	0.016	0.064	0
Rock sole	0.148	0.148	0.030	0.104	0
Turbot	0.021	0.021	0.028	0.015	0
Yellowfin	2.480	2.480	0.848	1.739	0
Flats (other)	0.197	0.197	0.019	0.138	0
Rockfish	0.081	0.081	0.065	0.029	0
Atka	0.044	0.044	0.035	0.031	0
Other	0.261	0.261	0.212	0.183	0
Total	**167.051**	**167.051**	**145.729**	**117.762**	**0**

Table F-16 Projected BSAI Shoreside 2008 Gross Revenue Net of CV Payments (millions of dollars)

Species Group	Shoreside Value Added by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	334.667	334.667	290.472	236.193	0
Sablefish	3.029	3.029	2.558	2.123	0
Pacific cod	23.185	23.185	24.214	16.252	0
Arrowtooth	0.657	0.657	0.074	0.461	0
Flathead sole	0.295	0.295	0.052	0.207	0
Rock sole	0.049	0.049	0.010	0.034	0
Turbot	0.003	0.003	0.005	0.002	0
Yellowfin	1.072	1.072	0.367	0.752	0
Flats (other)	1.144	1.144	0.110	0.802	0
Rockfish	0.190	0.190	0.153	0.068	0
Atka	0.132	0.132	0.105	0.092	0
Other	0.346	0.346	0.281	0.242	0
Total	**364.771**	**364.771**	**318.400**	**257.231**	**0**

Table F-17 Projected BSAI Combined 2008 Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	827.468	827.468	718.196	583.991	0
Sablefish	10.568	10.568	8.924	7.408	0
Pacific cod	126.485	126.485	132.098	88.663	0
Arrowtooth	27.081	27.081	3.048	18.983	0
Flathead sole	27.203	27.203	4.794	19.068	0
Rock sole	40.483	40.483	8.162	28.377	0
Turbot	3.025	3.025	4.026	2.120	0
Yellowfin	32.071	32.071	10.972	22.481	0
Flats (other)	36.382	36.382	3.503	25.503	0
Rockfish	8.564	8.564	6.882	3.075	0
Atka	29.027	29.027	23.141	20.347	0
Other	3.163	3.163	2.568	2.217	0
Total	**1,171.521**	**1,171.521**	**926.314**	**822.234**	**0**

Table F-18 Projected BSAI CDQ CP 2007 First Wholesale Gross Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	98.121	98.121	76.936	69.172	0
Sablefish	0.082	0.082	0.062	0.058	0
Pacific cod	11.140	11.140	10.525	7.809	0
Arrowtooth	0.142	0.142	0.112	0.100	0
Flathead sole	0.349	0.349	0.151	0.245	0
Rock sole	0.653	0.653	0.177	0.458	0
Turbot	0.055	0.055	0.077	0.039	0
Yellowfin	2.940	2.940	0.936	2.061	0
Flats (other)	0.107	0.107	0.081	0.075	0
Rockfish	0.529	0.529	0.425	0.188	0
Atka	3.239	3.239	2.192	2.271	0
Other	0.183	0.183	0.175	0.129	0
Total	**117.541**	**117.541**	**91.848**	**82.603**	**0**

Table F-19 Projected BSAI CDQ CV 2007 EX-Vessel Gross Revenue (millions of dollars)

Species Group	Ex-Vessel Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	4.020	4.020	3.152	2.834	0
Sablefish	0.987	0.987	0.740	0.692	0
Pacific cod	0.058	0.058	0.054	0.040	0
Arrowtooth	0.000	0.000	0.000	0.000	0
Flathead sole	0.000	0.000	0.000	0.000	0
Rock sole	0.001	0.001	0.000	0.001	0
Turbot	0.001	0.001	0.001	0.001	0
Yellowfin	0.000	0.000	0.000	0.000	0
Flats (other)	0.000	0.000	0.000	0.000	0
Rockfish	0.001	0.001	0.001	0.000	0
Atka	0.000	0.000	0.000	0.000	0
Other	0.001	0.001	0.001	0.001	0
Total	**5.070**	**5.070**	**3.951**	**3.570**	**0**

Table F-20 Projected BSAI CDQ Shoreside 2007 Gross Revenue Net of CV Payments (millions of dollars)

Species Group	Shoreside Value Added by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	9.304	9.304	7.295	6.559	0
Sablefish	0.657	0.657	0.493	0.461	0
Pacific cod	0.092	0.092	0.087	0.065	0
Arrowtooth	0.002	0.002	0.002	0.002	0
Flathead sole	0.001	0.001	0.001	0.001	0
Rock sole	0.000	0.000	0.000	0.000	0
Turbot	0.000	0.000	0.000	0.000	0
Yellowfin	0.000	0.000	0.000	0.000	0
Flats (other)	0.001	0.001	0.000	0.000	0
Rockfish	0.002	0.002	0.002	0.001	0
Atka	0.000	0.000	0.000	0.000	0
Other	0.002	0.002	0.002	0.002	0
Total	**10.063**	**10.063**	**7.883**	**7.091**	**0**

Table F-21 Projected BSAI CDQ Combined 2007 Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	111.445	111.445	87.383	78.565	0
Sablefish	1.727	1.727	1.295	1.210	0
Pacific cod	11.290	11.290	10.666	7.914	0
Arrowtooth	0.145	0.145	0.114	0.102	0
Flathead sole	0.351	0.351	0.151	0.246	0
Rock sole	0.655	0.655	0.177	0.459	0
Turbot	0.056	0.056	0.079	0.039	0
Yellowfin	2.940	2.940	0.937	2.061	0
Flats (other)	0.108	0.108	0.082	0.076	0
Rockfish	0.533	0.533	0.428	0.189	0
Atka	3.239	3.239	2.192	2.271	0
Other	0.187	0.187	0.178	0.131	0
Total	**132.674**	**132.674**	**103.682**	**93.263**	**0**

Table F-22 Projected BSAI CDQ CP 2008 First Wholesale Gross Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	80.997	80.997	70.301	57.164	0
Sablefish	0.071	0.071	0.060	0.050	0
Pacific cod	9.129	9.129	9.535	6.400	0
Arrowtooth	1.028	1.028	0.116	0.721	0
Flathead sole	0.828	0.828	0.146	0.580	0
Rock sole	0.850	0.850	0.171	0.596	0
Turbot	0.055	0.055	0.073	0.039	0
Yellowfin	2.671	2.671	0.914	1.872	0
Flats (other)	0.792	0.792	0.076	0.555	0
Rockfish	0.529	0.529	0.425	0.190	0
Atka	2.320	2.320	1.849	1.626	0
Other	0.217	0.217	0.176	0.152	0
Total	**99.488**	**99.488**	**83.843**	**69.945**	**0**

Table F-23 Projected BSAI CDQ CV 2008 EX-Vessel Gross Revenue (millions of dollars)

Species Group	Ex-Vessel Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	3.318	3.318	2.880	2.342	0
Sablefish	0.854	0.854	0.721	0.599	0
Pacific cod	0.047	0.047	0.049	0.033	0
Arrowtooth	0.003	0.003	0.000	0.002	0
Flathead sole	0.001	0.001	0.000	0.001	0
Rock sole	0.001	0.001	0.000	0.001	0
Turbot	0.001	0.001	0.001	0.001	0
Yellowfin	0.000	0.000	0.000	0.000	0
Flats (other)	0.001	0.001	0.000	0.001	0
Rockfish	0.001	0.001	0.001	0.000	0
Atka	0.000	0.000	0.000	0.000	0
Other	0.001	0.001	0.001	0.001	0
Total	**4.229**	**4.229**	**3.655**	**2.980**	**0**

Table F-24 Projected BSAI CDQ Shoreside 2008 Value Added Revenue (millions of dollars)

Species Group	Shoreside Value Added by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	7.680	7.680	6.666	5.421	0
Sablefish	0.569	0.569	0.480	0.399	0
Pacific cod	0.076	0.076	0.079	0.053	0
Arrowtooth	0.018	0.018	0.002	0.012	0
Flathead sole	0.003	0.003	0.001	0.002	0
Rock sole	0.000	0.000	0.000	0.000	0
Turbot	0.000	0.000	0.000	0.000	0
Yellowfin	0.000	0.000	0.000	0.000	0
Flats (other)	0.004	0.004	0.000	0.003	0
Rockfish	0.002	0.002	0.002	0.001	0
Atka	0.000	0.000	0.000	0.000	0
Other	0.003	0.003	0.002	0.002	0
Total	**8.356**	**8.356**	**7.233**	**5.893**	**0**

Table F-25 Projected BSAI CDQ Combined 2008 Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	91.996	91.996	79.847	64.926	0
Sablefish	1.494	1.494	1.262	1.047	0
Pacific cod	9.252	9.252	9.663	6.486	0
Arrowtooth	1.049	1.049	0.118	0.735	0
Flathead sole	0.832	0.832	0.147	0.583	0
Rock sole	0.852	0.852	0.172	0.597	0
Turbot	0.056	0.056	0.075	0.039	0
Yellowfin	2.672	2.672	0.914	1.873	0
Flats (other)	0.797	0.797	0.077	0.559	0
Rockfish	0.533	0.533	0.428	0.191	0
Atka	2.320	2.320	1.850	1.626	0
Other	0.221	0.221	0.179	0.155	0
Total	**112.073**	**112.073**	**94.730**	**78.818**	**0**

Table F-26 Projected GOA CP 2007 First Wholesale Gross Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	0.130	0.112	0.089	0.051	0
Sablefish	9.569	9.569	7.893	4.398	0
Pacific cod	7.730	7.730	4.318	3.553	0
Arrowtooth	21.017	4.331	1.869	1.991	0
Flathead sole	3.972	0.929	0.223	0.427	0
Rex sole	19.951	4.670	1.542	2.147	0
Flats deep	0.004	0.004	0.000	0.002	0
Flats shallow	0.557	0.216	0.056	0.099	0
Rockfish	10.666	9.842	6.520	3.303	0
Atka	0.460	0.147	0.048	0.067	0
Skates	0.500	0.500	0.166	0.230	0
Other	0.027	0.027	0.011	0.012	0
Totals	**74.582**	**38.077**	**22.735**	**16.282**	**0**

Table F-27 Projected GOA CV 2007 EX-Vessel Gross Revenue (millions of dollars)

Species Group	Ex-Vessel Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	15.464	13.263	10.581	6.096	0
Sablefish	44.101	44.101	36.375	20.271	0
Pacific cod	17.671	17.671	9.871	8.123	0
Arrowtooth	1.561	0.322	0.139	0.148	0
Flathead sole	0.820	0.192	0.046	0.088	0
Rex sole	0.328	0.077	0.025	0.035	0
Flats deep	0.141	0.141	0.011	0.065	0
Flats shallow	2.536	0.984	0.254	0.453	0
Rockfish	3.539	3.266	2.164	1.096	0
Atka	0.001	0.000	0.000	0.000	0
Skates	0.407	0.407	0.135	0.187	0
Other	0.114	0.114	0.048	0.052	0
Totals	**86.683**	**80.537**	**59.649**	**36.615**	**0**

Table F-28 Projected GOA Shoreside 2007 Value Added Revenue (millions of dollars)

Species Group	Shoreside Value Added by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	24.700	21.185	16.901	9.738	0
Sablefish	7.335	7.335	6.050	3.372	0
Pacific cod	18.499	18.499	10.333	8.503	0
Arrowtooth	3.895	0.803	0.346	0.369	0
Flathead sole	1.708	0.400	0.096	0.184	0
Rex sole	0.542	0.127	0.042	0.058	0
Flats deep	0.346	0.346	0.027	0.159	0
Flats shallow	5.458	2.119	0.546	0.974	0
Rockfish	4.040	3.728	2.469	1.251	0
Atka	0.014	0.004	0.001	0.002	0
Skates	0.253	0.253	0.084	0.116	0
Other	0.071	0.071	0.030	0.033	0
Totals	**66.861**	**54.869**	**36.927**	**24.759**	**0**

Table F-29 Projected GOA Combined 2007 Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	40.294	34.559	27.571	15.886	0
Sablefish	61.005	61.005	50.318	28.042	0
Pacific cod	43.901	43.901	24.522	20.179	0
Arrowtooth	26.473	5.455	2.354	2.508	0
Flathead sole	6.500	1.521	0.366	0.699	0
Rex sole	20.820	4.874	1.609	2.240	0
Flats deep	0.492	0.492	0.039	0.226	0
Flats shallow	8.552	3.320	0.856	1.526	0
Rockfish	18.245	16.835	11.153	5.650	0
Atka	0.474	0.151	0.049	0.070	0
Skates	1.159	1.159	0.385	0.533	0
Other	0.211	0.211	0.090	0.097	0
Totals	**228.125**	**173.483**	**119.311**	**77.655**	**0**

Table F-30 Projected GOA CP 2008 First Wholesale Gross Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	0.128	0.114	0.095	0.056	0
Sablefish	8.591	8.591	7.683	4.187	0
Pacific cod	5.263	5.263	3.859	2.565	0
Arrowtooth	19.410	4.331	1.903	2.111	0
Flathead sole	3.322	0.940	0.234	0.458	0
Rex sole	8.751	4.670	1.768	2.276	0
Flats deep	0.004	0.004	0.000	0.002	0
Flats shallow	0.557	0.216	0.054	0.105	0
Rockfish	10.909	10.116	6.595	3.457	0
Atka	0.460	0.147	0.056	0.071	0
Skates	0.500	0.500	0.166	0.243	0
Other	0.087	0.027	0.011	0.013	0
Totals	**57.981**	**34.919**	**22.424**	**15.546**	**0**

Table F-31 Projected GOA CV 2008 EX-Vessel Gross Revenue (millions of dollars)

Species Group	Ex-Vessel Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	15.219	13.545	11.296	6.602	0
Sablefish	39.594	39.594	35.409	19.298	0
Pacific cod	12.031	12.031	8.821	5.864	0
Arrowtooth	1.442	0.322	0.141	0.157	0
Flathead sole	0.685	0.194	0.048	0.095	0
Rex sole	0.144	0.077	0.029	0.037	0
Flats deep	0.141	0.141	0.011	0.069	0
Flats shallow	2.536	0.984	0.244	0.480	0
Rockfish	3.620	3.357	2.189	1.147	0
Atka	0.001	0.000	0.000	0.000	0
Skates	0.407	0.407	0.135	0.198	0
Other	0.370	0.114	0.048	0.055	0
Totals	**76.191**	**70.766**	**58.371**	**34.003**	**0**

Table F-32 Projected GOA Shoreside 2008 Value Added Revenue (millions of dollars)

Species Group	Shoreside Value Added by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	24.310	21.635	18.043	10.545	0
Sablefish	6.586	6.586	5.890	3.210	0
Pacific cod	12.594	12.594	9.234	6.139	0
Arrowtooth	3.597	0.803	0.353	0.391	0
Flathead sole	1.429	0.404	0.100	0.197	0
Rex sole	0.238	0.127	0.048	0.062	0
Flats deep	0.346	0.346	0.026	0.169	0
Flats shallow	5.458	2.119	0.525	1.033	0
Rockfish	4.132	3.831	2.498	1.310	0
Atka	0.014	0.004	0.002	0.002	0
Skates	0.253	0.253	0.084	0.123	0
Other	0.230	0.071	0.030	0.035	0
Totals	**59.187**	**48.774**	**36.833**	**23.215**	**0**

Table F-33 Projected GOA Combined 2008 Revenue (millions of dollars)

Species Group	First Wholesale Value by Alternative (millions of dollars)				
	A1	A2	A3	A4	A5
Pollock	39.657	35.295	29.434	17.203	0
Sablefish	54.771	54.771	48.982	26.696	0
Pacific cod	29.888	29.888	21.913	14.568	0
Arrowtooth	24.448	5.455	2.397	2.659	0
Flathead sole	5.436	1.538	0.382	0.750	0
Rex sole	9.132	4.874	1.845	2.376	0
Flats deep	0.492	0.492	0.037	0.240	0
Flats shallow	8.552	3.320	0.822	1.618	0
Rockfish	18.661	17.304	11.282	5.914	0
Atka	0.474	0.151	0.058	0.074	0
Skates	1.159	1.159	0.385	0.565	0
Other	0.687	0.211	0.090	0.103	0
Totals	**193.359**	**154.458**	**117.629**	**72.764**	**0**

Comparison of Model 2004 Gross Revenue Estimates with 2004 Estimates from the 2005 Economic SAFE.

The annual Economic SAFE report provides gross revenue estimates for groundfish fisheries. This section provides comparisons of 2004 gross revenue estimates from the 2005 Economic SAFE with the 2004 gross revenue estimates provided by the model. This exercise is meant to provide a sense of the level of uncertainty associated with the model gross revenue estimates. Important differences between the revenue estimates from the two sources may be generated by the different methodologies. A key difference is that the catch and retention ratios used in the gross revenues model are averages of five years of these ratios in the fishery, while the 2005 Economic SAFE uses the ratios that were observed in 2004.

Further limiting the comparability of the estimates, the figures in the SAFE document are also based on different accounting conventions than those in the gross revenue model. Of note, however, is that the Economic SAFE includes values for some State managed groundfish fisheries that are not included in the model. The total ex-vessel value of State Managed Groundfish fisheries was approximately $21 million in 2004 (ADF&G, http://www/cf.adfg.state.ak.us.) Thus, it is likely that these State managed fisheries contribute close to the $15 million dollar difference between the model estimation and the Economic SAFE value for 2004. Moreover, the model treats mothership landings as Catcher Vessel landings at all times, whereas the Economic SAFE Table 56 treats catcher processors that act as motherships at some time during the year as catcher processors for the entire year. The Economic SAFE breaks motherships that only operate as motherships out into a separate category.

Table F-34 provides a comparison of the model's 2004 gross revenue estimates with 2004 gross revenue estimates from the 2005 Economic SAFE. The model estimates in Table F-34 are highly aggregated (BSAI, BSAI CDQ, and GOA combined) in this comparison. In total, the model gross revenue estimate is approximately equal to the gross revenue estimate from the Economic SAFE. The two estimates are less than one percent apart.

A species by species comparison shows that the model estimates approximately 3 percent more pollock revenue than recorded in the Economic SAFE for 2004. The model also estimates greater revenue for Pacific cod and Atka mackerel than was recorded in the Economic SAFE. In contrast, the model estimates less revenue than recorded in the Economic SAFE for sablefish, flatfishes, and rockfish.

Table F-34 Comparison of Total 2004 First Wholesale Revenue Estimates for the North Pacific Groundfish Fishery from the Gross Revenue Model and the 2005 Economic SAFE.

Species Group	Model	Economic SAFE	Difference	Percent Difference
Pollock	1,131	1,098	33	2.88%
Sablefish	89	95	-6	-7.24%
Pacific cod	290	282	8	2.69%
Flatfish	84	100	-16	-18.82%
Rockfish	22	25	-3	-12.76%
Atka Mackerel	30	29	1	4.55%
Total	**1,646**	**1,661**	**-15**	**-0.91%**

Sources: NMFS Gross Revenue Model and 2005 Economic SAFE Table 25, page 53

A further comparison of model versus 2004 Economic SAFE revenue estimates by processing mode is presented in table F-35. The same fundamental difficulties as cited immediately above, also confound attempts to make direct comparisons, by processing mode. Given these differences, it is difficult to directly compare the model output with Economic SAFE values. Regional and overall totals may be more comparable. The regional totals indicate that the model may underestimate GOA revenue but overestimate BSAI revenue. Summing total gross revenues over both the BSAI and GOA, the gross revenues model and the Economic SAFE revenue estimates are approximately equal. The two estimates are only about one percent apart.

Table F-35 Comparison of 2004 Total First Wholesale Revenue Estimates for the North Pacific Groundfish Fisheries from the Gross Revenue Model and the 2005 Economic SAFE by Processing Mode

Sector	Model	Economic SAFE	Difference	Percent Difference
GOA at sea	40	32	-8	-25.91%
GOA shoreside	148	195	47	23.86%
Subtotal	189	227	38	16.84%
BSAI mothership	-	89		
BSAI CP	822	860	38	4.37%
BSAI shoreside	634	486	-145	-29.74%
Subtotal	1,457	1,438	-19	-1.31%
Total	1,646	1,661	15	0.90%

Sources: NMFS-AKR Gross Revenue Model and 2005 Economic SAFE table 31, page 62.
*The model does not include catch and landings in State of Alaska Managed Groundfish fisheries. The model calculates shoreside value added not shoreside gross revenue. Thus, model shoreside values in this chart are the sum of CV and shoreside values for the region. The model treats all mothership landings as catcher vessel landings.
**The SAFE document includes State of Alaska Managed Groundfish fisheries data. The SAFE document calculates shoreside first wholesale gross revenue. The SAFE document treats catcher processors that act as motherships at some time during the year as catcher processors for the entire year.

One further comparison is possible. Table F-36 compares model gross revenue estimates with Economic SAFE reported ex-vessel revenue by region. Once again, however, the values are difficult to compare due to structural differences in the way they are calculated and reported. The fundamental difference is that the model treats all mothership landings as ex-vessel landings; thereby including those landing in CV revenue estimates and shoreside value added estimates derived from the CV estimates. This is because the catch and retention data collected by NMFS-AKR in Season Management staff are reported in this way. In contrast, the Economic SAFE reports (table 20), the ex-vessel value that is actually delivered to shoreside processors, which does not include the mothership deliveries. The Economic SAFE reports the mothership values as first wholesale values in Table 23. As shown in Table F-35 above, mothership first wholesale revenue is reported as $89 million in 2004.

As shown in Table F-36, the model under-predicts GOA 2004 ex-vessel revenue by about $4 million, or by about 4 percent. Since the values reported in table 20 of the Economic SAFE only include harvests counting against Federal TACs (i.e., does not include State Managed Fishery data), this discrepancy is unexplained. For the BSAI, the model estimates ex-vessel revenue that is about $63 million (46 percent) more than reported in the Economic SAFE document. Overall, the model estimates about $59 million (25 percent) greater ex-vessel revenue in the North Pacific Groundfish Fishery than reported in the Economic SAFE Document. This is likely due to the differing way the model and the Economic SAFE treat mothership data.

Table F-36 Comparison of 2004 Model and SAFE Ex-Vessel Revenue Estimates

Sector	Model*	Economic SAFE**	Difference	Percent Difference
GOA	91	95	4	4%
BSAI	201	138	-63	-46%
Total	292	233	-59	-25%

Source: NMFS-AKR Gross Revenue Model and 2004 Economic Safe Table 20, page 49.
*The model treats all mothership landings as catcher vessel landings.
**The SAFE document reports only deliveries to shoreside processors in table 20.

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Appendix G: SSC Comments

This appendix extracts the sections December 2005 SSC minutes that discuss SSC review of the specifications EA for the 2006 and 2007 TACS. This EIS has evolved out of that EA. NMFS responses to SSC comments are underlined.

SSC Minutes from the December 2005 meeting

D1(a) BSAI and GOA Harvest Specifications for 2006 – 2007

Ben Muse (NMFS AK Region) summarized the EA and updated the SSC on changes to the document relative to the October version. The SSC welcomes review of this document and acknowledges that the document provides a comprehensive review of the impacts of TAC setting.

The authors addressed several of the SSC comments made during the October meeting. The authors provided more documentation on the projection methods and briefed the Plan Teams at their November meetings on this aspect of the document. **It was noted that the projections could be improved by involving stock assessment authors earlier in the process to reduce the need for changes in September.** NMFS agrees, and will provide stock assessment authors with the 2006 and 2007 mortality estimates used to generate the 2007 and 2008 TAC projections in Chapter 2 of this EIS.

Preliminary projections indicated that GOA pollock catches would increase and in October the SSC discussed the need to monitor these increases with respect to Steller sea lion status and trends. The EA authors noted that this SSC concern was no longer relevant because the final projected GOA pollock ABC will decline rather than rise in 2006.

In October, the SSC also requested that the EA authors consider estimating error bounds on economic estimates. The authors noted that this request could be accommodated but the drafters sought guidance on methodology. The SSC is encouraged that future EA analyses will attempt to incorporate estimates of uncertainty in economic projections. While there are many different sources of uncertainty that could be incorporated into economic projections, in the near term, data should be readily available to quantify uncertainty due to variability in ex-vessel and first-wholesale prices and variability in the mix of product forms. In the long term, it is anticipated that models will be developed to formally represent supply, demand, and trade relationships. The SSC anticipates that, as these models are developed, they will be documented in Appendix D—Economic Status of the Groundfish Fisheries. NMFS used an Excel add-in to develop a Monte Carlo approach to addressing the uncertainties associated with the gross revenue projections. This work has not been completed at this time. An important area for future work is in developing and summarizing information on the confidence intervals appropriate for the price variables being used.

The SSC requests documentation of changes in forecasts of OFLs and ABCs over time as they change throughout the two-year harvest specification cycle. This type of information would be useful to validate the process, inform the public on the expected impacts of an action, and to identify stocks for which projections are problematic and in need of improvement. NMFS agrees that this information will be helpful. NMFS briefed the joint Plan Teams on the evolution of the 2006 ABCs at their November 2005 meetings, and intends to provide similar information to the Plan Teams, the SSC, and other interested parties, during the 2007-2008 specifications cycle.

The SSC offers the following editorial comments and suggestions for future EA documents [page numbers refer to the 2006-2007 TAC Specifications EA].

- P. 47. Terminology – The authors should consider selecting either "ecosystem based management" or "ecosystem approaches to management" and should be consistent in their usage.
- The SSC request has been addressed by using the term "ecosystem-sensitive management." This is used in this EIS in preference to the terms "ecosystem-based management" and "ecosystem approaches to management." The term was chosen to indicate a wide range of measures designed to improve our understanding of the interactions between groundfish fishing and the broader ecosystems, to reduce or mitigate the impacts of fishing on the ecosystems, and to modify fisheries governance to integrate ecosystems considerations into management. The term was used because it is not a term of art or commonly used term which might have very specific meanings. When the term "ecosystem-based management is used," it is meant to reflect usage by other parties in public discussions.changing references to "ecosystem approaches to management" so that they refer to "ecosystem-based" management.
- P. 47 – The authors mention the potential use of ecosystem indicators as an early warning of potential regime shifts. The authors should note that, in addition to exploring changes to harvest controls to adjust for changes in productivity resulting from regime shifts, assessment authors are conducting MSE type analyses to evaluate whether their harvest policies are robust to regime shifts. The latter approach may be more practical as it is often difficult to identify a regime shift with confidence early in the time series. MSE refers to "management strategy evaluation". In an MSE, management strategies are tested in model simulations of a fishery and its environmental context. It is possible to test the success of management strategies under different conditions, such as shifts in ecosystem regimes. The AFSC is currently conducting MSEs for several groundfish fisheries, including for several flatfish species in the BS, and for pollock in the GOA. The discussion in the text has been elaborated to make this point.
- P. 64 – The authors should consider inclusion of results from the U.S. GLOBEC studies that were published in a recent volume of Deep Sea Research. U.S. GLOBEC (GLOBal ocean ECosystems dynamics) refers to a research program evaluating the impact of global climate change on "the abundance and production of animals in the sea." The U.S. GLOBEC program has a web site at http://www.usglobec.org/ . The EIS uses the "Ecosystems Considerations for 2006" chapter of the 2005 SAFE reports as the primary source of systemized information on ecosystems considerations for the North Pacific. This EIS has tried to deepen the connection between this NEPA analysis and the ecosystem chapter somewhat. NMFS has not extended its use of other resources for the preparation of this document.
- P. 69 - 71. The SSC notes that the importance of factors leading to concentration of fisheries in time or space has been removed from the target species impacts. This is an important potential impact that could be expressed through genetic impacts and reproductive success. The authors should note this in the description of significance criteria. In earlier years, the EA used genetic structure and reproductive success as indicators of spatial and temporal impacts of the alternative on target species. These two indicators were retained in the 2006-2007 Specifications EA, however, text indicating their significance as temporal and spatial indicators was eliminated. New text has been added to in this version of the EA, indicating that these are indicators of spatial and temporal impacts. Moreover, the criteria for non-specified species, forage species, and prohibited species, have been elaborated to begin to utilize these criteria, as well as the other criteria formerly used for target species.
- P. 83, 88, 93. The authors mention the benefits of ecosystem approaches to management. However, the item might be better titled "Ecosystem Research." The types of activities listed are not management issues. Rather, they are benefits of ecosystem research. NMFS has not adopted the SSC suggestion. The suggestion referred to the ecosystem section in the cumulative effects analysis of target, non-specified, and forage fisheries. The title "Ecosystem approaches to management" (changed to "Ecosystem-sensitive management" as described above) was defined in Section 4.1 of the EA to include the research that underlies ecosystem management, protection

of non-target species elements of the environment, and the integration of ecosystem considerations into management. The use of the term in the sections on which the SSC comments is meant to be consistent with that definition. Moreover, some elements, such as the steps to provide more species protection for other species such as sharks and octopus, represent ecosystem management steps which go beyond research.

- P. 85 – The authors should clarify that aquaculture is not allowed in AK, at least not in state waters, so the impacts of aquaculture are likely to be limited to impacts on fish prices. The text has been edited to make this clarification.
- P. 90 – The authors should reconsider the threshold for significance for forage fish given that current impacts by fishing activities are so small. An EA was used for the NEPA analysis of the 2006-2007 specifications. NMFS noted in the final EA that it believed the significance criterion in use was potentially too conservative, and committed to reviewing the use of that criterion. The decision to meet NEPA responsibilities with an EIS has meant that the use of this criterion to determine significance is no longer needed to support a legal finding. Therefore, the criterion has been eliminated. Forage fish impacts are now described to address the five impact indicators (mortality, genetic structure, reproductive success, prey and habitat) that were formerly used only for target species.